SCIENTIFIC AMERICAN

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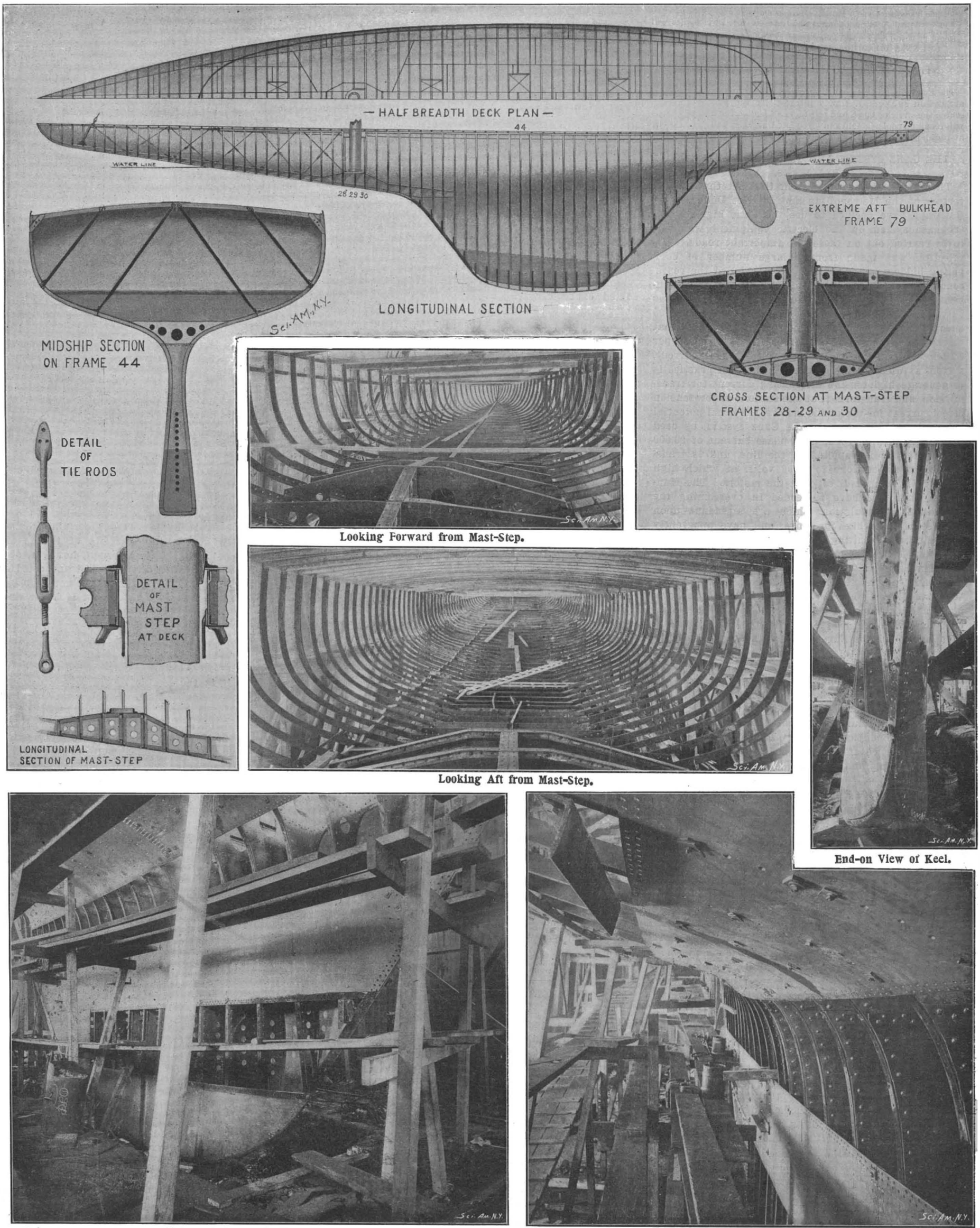
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXIV.—No. 13. ESTABLISHED 1845. NEW YORK, MARCH 30, 1901. $3.00 A YEAR. 8 CENTS A COPY.



Looking Forward from Mast-Step.

Looking Aft from Mast-Step.

End-on View of Keel.

Fin-Keel and Bulb, Looking Toward Stern.

Garboard Strake and Keel Framing.

Length over all, 140 feet 10½ inches. **Water-line length,** 90 feet. **Extreme beam,** 23 feet 11⅛ inches. **Draught,** 20 feet. **Ballast,** 75 tons. **Displacement,** 146.75 tons.

Photographs by Thos. E. Marr, Boston.

THE INTERNATIONAL RACING-YACHT "INDEPENDENCE." [See page 198.]

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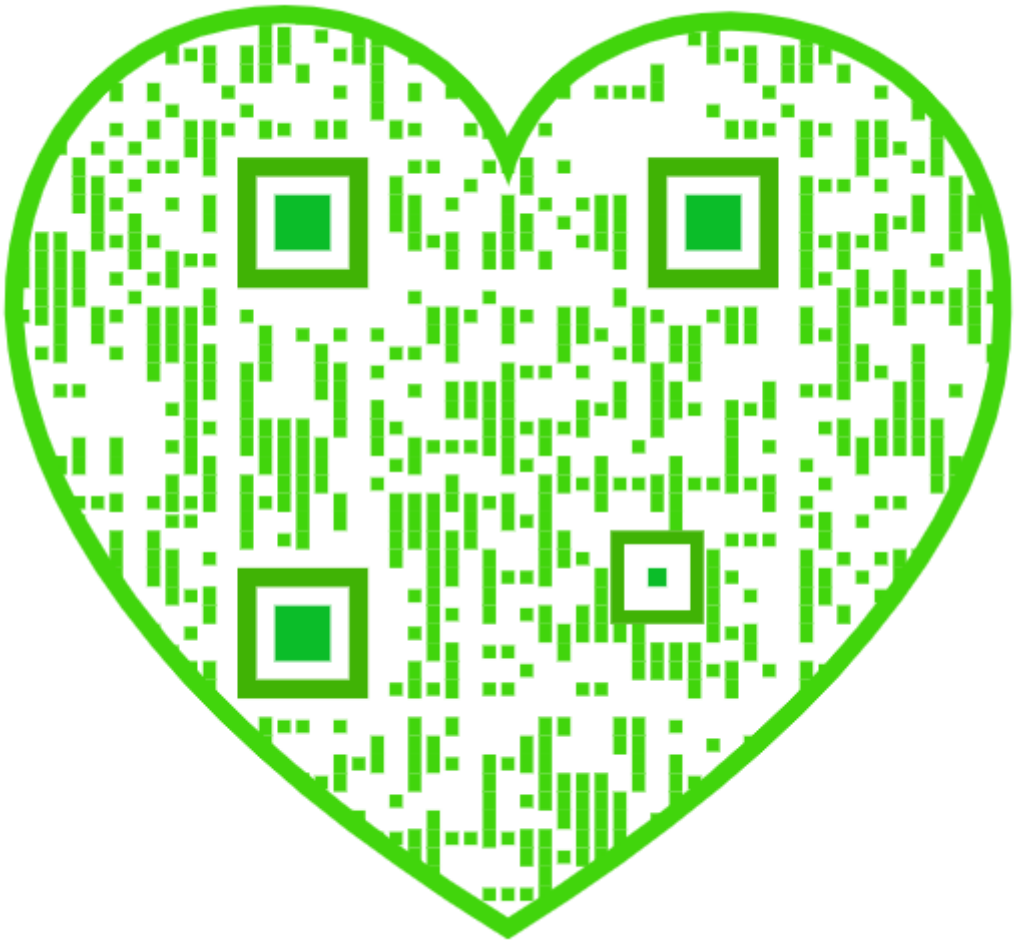

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MARCH 30, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE GANZ SYSTEM AND THE LONDON ELECTRIC RAILWAYS.

There is food for thought in the fact that the directors of the Metropolitan and District Underground Railways have decided to use the Ganz high-voltage, tri-phase system in the electric equipment which is to be carried out on these two important roads. The selection was made from a large number of competing bidders, among whom were included the representatives of the leading electrical firms in this country. It is stated that the choice of the directors was based upon the fact that the Ganz bid was $1,000,000 cheaper than the lowest American tender, and that the operating expenses were represented to be 30 per cent lower than those of the low-voltage, direct-current, system as used in this country. American practice is to generate high-tension alternating current for transmission, and transform it at sub-stations to low-tension direct current for use at the motors, the usual potential being about 500 volts. In the Ganz system, as used in the new Italian road, three-phase current of 20,000 volts potential is supplied to the line, and is transformed at sub-stations to 3,000 volts, at which high pressure it is used directly at the motors. The Hungarian engineers have succeeded in overcoming the difficulties of insulation which are attendant upon the use of such high pressure, and have apparently gained all the resulting economies of construction and operation.

It can justly be claimed that America is the birthplace and the home of successful electric traction. We have hitherto led the world both in the improvement and development of this system of transportation, and to many people it will come as something of a shock that a European firm should apparently have moved ahead of us in the improvement of the art. If the contract should be secured by the Budapest firm it will be but another illustration of the fact that, however supreme a nation may be in any particular industry, it can never afford to rest upon its laurels. It must be prepared to meet an ever-extending competition, as other nations begin to center their intelligence and skill upon the improvement of existing systems and plants.

CUP-YACHT DESIGNING.

Since the year 1893, when four yachts were built for the defense of the "America" Cup, the responsibility of designing a defender has rested upon the shoulders of one man, whose name is identified throughout the yachting world with the fastest craft that have ever hoisted canvas in an international cup race. Although the cup has proved on three memorable occasions to be perfectly safe when its defense was intrusted to Mr. Herreshoff, it is believed that its future security would be better assured if more than one designer were engaged at each contest in the production of an "America" Cup defender. The task of constructing the fragile hull of a 90-footer, and giving it the necessary strength to carry its enormous load of lead below, and above, its towering spread of canvas, requires both skill and experience. Experience and an accumulation of well proved data are especially valuable, for it is a well-known fact that yacht designing is not an exact science, not, at least, in the sense in which bridge construction may be said to be so. Originally the yacht-builder was a man of rule-of-thumb methods altogether, and there are even to day many points, both in the modeling of the boat and in her sail plan, which are determined, not by scientific formula, but by the particular fads or prejudice of the individual designer. One man prefers bluffer bows and leaner quarters; another thinks that better results come from a straight, sharp entrance and rather full, broad quarters, as in the "Shamrock" of two years ago. In one sail plan we see the cloths running parallel with the leech, in another they are cross-cut; while the controversy as to whether sails should be as flat as the proverbial board, or whether they should have left in them something of that bagginess to which the English yachtsmen who succumbed half a century ago to the "America" largely attributed their defeat, is still a matter for conjecture. One yachting sharp believes in setting up his rigging perfectly taut; another will tell you, as the father of a noted yacht designer interested in the last cup contest did, that "Shamrock" lost the races because the rigging was not slacked up to the degree which insures getting the best results out of the sails!

All of which goes to prove that there may be more things in yachting philosophy than have yet been dreamed of, and the steady increase in speed which has taken place of late years gives reason to believe that we have by no means reached, in form of hull or in sail plan, the theoretically perfect racing craft. The more designers of cup defenders, then, the more ideas, the more proved and reliable data, the more development, and, most important of all, the less possibility that the successful defense of the cup will cease with the incapacitation or death of one individual.

For this reason we are glad to note that this year there are two yacht designers engaged in the task of defending the "America" Cup, and the more so as the yacht which is being built from Mr. Crowninshield's designs is of a type which will differ very widely in some respects from what might be called the typical Herreshoff model. Although no particulars have yet been given out, it is practically certain that the new Herreshoff boat will be an improved "Columbia," and will embody in herself the accumulated experience which has resulted from the construction and sailing of the "Vigilant" and "Defender" and "Columbia." It is also probable, in spite of certain sensational rumors to the contrary, that the new Watson boat which is building at the Denny's yard will be in all respects a standard Watson craft, the lineal descendant of the "Britannia," "Valkyrie," "Meteor" and last year's "Sybarita." There will be far more likeness between the Watson and Herreshoff boats than there will be between the Herreshoff and the Crowninshield craft; and, strange as it may seem, it is possible that from a yacht constructor's purely technical point of view, there will be greater interest evinced in a contest between the two American craft than there would be between the Herreshoff boat and the English challenger.

The "Independence," whose plans are fully described elsewhere, is an attempt to apply to the 90 foot yacht a form of hull which has been developed of late years in the keen competition between small craft of 15 and 20-foot waterline. In no branch of yachting has greater ingenuity or freer inventiveness been shown than by the designers of these little "raters." A wide variety of models, many of them positively grotesque, have been built and tested: boats of great beam and enormous overhang, flat-ended boats, boats with wing ballast, others with keel ballast, and others with none at all; while out of the competition there has been evolved what is known as the scow-form of yacht, which is, for its size, by far the fastest sail-driven craft with a single hull in the world. The "scow" has enormous overhangs, a flat floor and a hard bilge. Her beam is ridiculously wide; when she is heeled her model is such that her sailing-length is almost doubled, while the weather half of the boat, lifted often entirely out of the water, is depended upon to give the boat stability. The "Independence" is practically of a modified scow form, with the deep fin-keel and lead ballast of the typical 90-footer hung beneath it. When she heels to a breeze her sailing length will be increased far beyond that of any previous cup contestant, and unless there is any serious difficulty with the steering and control of the boat when there is any weight in the wind, the great spread of sail which she will be able to carry, coupled with her relatively small displacement, should render her an extremely fast yacht.

YELLOW FEVER.

Now that we have before us the full and authentic report of the proceedings of the Pan-American Medical Congress held in Havana 4th to 7th of February, the most important subject of which was the presentation and discussion of the report of the special yellow fever commission, we are able to form an unbiased opinion and to estimate to some degree the far-reaching influence which the findings of this commission will have upon the theories of the causation of disease and of contagion and infection, as well as upon vaccination and preventive inoculation.

Summarized, this report is as follows: Yellow fever cannot be communicated by contact with the patient or with the clothes or other articles worn by a patient before and during the course of the disease, although they may be impregnated with the excretion of the body. The disease is, therefore, not contagious. It can, however, be communicated by inoculation if a small quantity of blood from a yellow fever patient, taken during the first two days of the disease, is injected into a healthy person. If, however, the blood is taken later in the disease, or before the attack has set in, no result is obtained.

Yellow fever is communicated, however, by the bite of a particular kind of mosquito (the Culex fascinatus) that has previously bitten a yellow fever patient during the first two days of the attack. It takes twelve days for the specific poison to develop in the mosquito. Healthy persons bitten by such inoculated mosquitoes before the twelfth day after the contamination of the insect showed no symptoms of the disease, while those bitten after the twelfth day, without exception, were stricken with yellow fever after a lapse (period of incubation) of from forty-six hours to six days. Disinfection of houses and belongings of yellow fever patients, fumigation of letters from yellow fever districts, and quarantining of passengers from infected localities would therefore be unnecessary, provided the mosquito were destroyed.

The report concludes: "While the mode of propagation of yellow fever has now been definitely determined, the specific cause of this disease remains to be discovered." In the numerous reports of yellow fever epidemics in this country and abroad, and in the lengthy and erudite dissertations in medical literature, we find that the theory of contagion was by no means universally accepted by medical authorities, and was disputed as early as 1812 by Dr. B. Colomar in his report on the yellow fever epidemic in 1811 in Spain. We can therefore readily accept the demonstration of the commission of the non-contagiousness of yellow fever. There are, however, many peculiarities in the transmission of the disease recorded in medical literature, which cannot, as yet, be fully explained by accepting the statement that the mosquito is the only carrier of the disease virus. It is true we can explain why General Butler succeeded in stamping out yellow fever in New Orleans by establishing proper sewerage and rendering the city habitable and healthful, but unhealthful for the Culex fascinatus, and why the epidemics invariably cease when the average temperature of the air falls below 70 deg. F. For we know that the insect cannot live in clean places or a cool atmosphere.

Other malarial diseases have been stamped out in certain localities by planting eucalyptus trees, which by their rapid growth and greed for moisture drain swampy places, or by the artificial draining of swamps, thereby making it impossible for certain species of mosquitoes which are the carriers of the fever to exist in these localities. We cannot, however, as yet explain in what manner the virus is transported over great distances of land or sea, distances too great for the culex to traverse. We must look for an explanation in the results of experiments which will determine what is the specific virus and what is its origin. For it is very plain, almost self-evident, that it is not a bacillus or coccus. It must be ascertained whether or no the eggs and larvæ of the infected mosquito (for it is the female insect only which sucks the blood of animals) carry within them the specific poison in a latent form to become potent in the fully developed insect, and if so what are the most favorable conditions of climate, temperature and surroundings for the development and life of the insects. Finally we must learn what is the most practical and effective method of destroying the insects and their eggs and larvæ.

When these questions have been answered we will be able to stamp out yellow fever and a number of other epidemic and endemic diseases and make the so-called "foci" of such diseases as yellow fever in Havana and the West Indies, and cholera in India, salubrious instead of disseminating depots of scourges for the whole world.

NEW METHOD OF AERIAL TELEGRAPHY.

The ingenious system devised by M. Paul Jegon for use in aerial telegraphy has for its object the localizing of messages sent by a given transmitter, so that of a given number of receivers within its radius of action, each post will receive the message intended for it and no other; it is not intended to assure the secrecy of the message. Each of the receiving stations has two masts of unequal length, and each of the masts is provided with a separate coherer and battery. The two circuits have in each of them a coil wound upon an iron core side by side, but in opposite directions, so that when a current flows in one of them an induction effect is produced in a third coil wound upon the core, but when both circuits act the effect is neutralized and the third coil is not acted upon. The third coil is connected with a galvanometer to indicate the presence of the signals. The case of two receiving stations of this kind, 1 and 2, placed at different distances from a transmitting station A, may be considered, and it will be found that communication may be made with one or the other at will. The transmitting station has two masts of unequal length, and the longest of these gives waves which are

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powerful enough to reach the station 2, and act upon its long mast, but not upon the shorter; thus A, by using the long mast, may communicate with B and deflect its galvanometer. As to the station 1 which is nearer A, the distance is so much shorter that the waves may act upon both the long and the short masts, and as the effect of the two circuits is neutralized the galvanometer will not be deflected. In this case it will be seen that A communicates with station 2 but not with 1. To produce the contrary effect the short mast of the transmitting station is used; its waves are not sufficiently powerful to act upon the distant station 2, nor even upon the shorter mast of station 1, but they act upon the long mast of 1, and the galvanometer is accordingly deflected. By a proper disposition this system may be applied to a number of receiving posts placed at different distances, and each receives its proper message.

BUILDERS' TRIAL OF THE "ILLINOIS."

The builders' trial of the U. S. battleship "Illinois" took place off Cape Henry Tuesday, March 12. The "Illinois" left the dock at the Newport News Shipbuilding and Dry Dock Company's yard at 7 o'clock A. M., proceeding down Hampton Roads to Old Point Comfort and Cape Henry, then to sea about 25 miles, where the trial for speed was made. The greatest speed, which was taken by log, was 16.2 knots, during which time the engines developed 11,920 I. H. P. at an average of 108.5 revolutions, and under a boiler pressure of 175 pounds. The vessel had been lying beside the dock for ten months, and her foul bottom accounts for the poor showing in speed. From the high horse power developed the indications are that, with a clean bottom, she will exceed the speed of her sister ships on the official trial. The "Illinois" is fitted with two sets of triple-expansion engines with cylinders 33½, 51 and 78 inches in diameter and 48 inches stroke. There are eight single-ended Scotch boilers 15 feet 8 inches diameter and 9 feet 11½ inches long, with 685 square feet of grate surface and 21,649 square feet of heating surface. Forced draught is furnished by eight blowers 60 inches diameter and 14 inches width of tip, each run by a 5 by 4 double engine. The propeller is 16 feet 9 inches diameter and set at 17 feet 3 inches pitch. The builders are well satisfied with the showing made and are rapidly preparing the vessel for the official trial.

THE PATENT OFFICE—RESIGNATION OF THE COMMISSIONER OF PATENTS

We are advised that the President has received the resignation of Charles H. Duell as Commissioner of Patents, who is about to return to active practice in this city, after having held the position of Commissioner very acceptably since February 5, 1898.

At the beginning of his administration he found the work in the Patent Office greatly in arrears, and at once set about devising means to bring it up to a more businesslike standard. His success in this direction is a matter of record and the present celerity with which applications receive attention, despite their increase in volume, is a satisfactory proof that his efforts have not been in vain. The promptitude with which applications can be acted upon is helpful to inventors from the fact that it tends to keep alive their ideas and stimulate further invention. It frequently happens that important industrial enterprises are dependent upon the prompt or tardy action of the Patent Office officials, hence it is to be hoped that the present efficiency will continue, and if possible be improved.

Mr. Duell also brought order out of chaos in reforming the distribution of printed copies of patents which are so largely used by attorneys and inventors by placing at the head of this division a competent, active business man.

The printed patent copies were formerly stored in various nooks, corners and hallways difficult to find, often in the wrong places, improperly or carelessly numbered, entailing an amount of worry and delay in their procurement that was extremely annoying to the attorney and inventor.

On account of the vast accumulation of printed copies and the storage space required only seventy-five copies of each patent are now printed, unless special orders are received in advance of the printing. By this change much less shelf space is needed and a saving of room is brought about.

The new head of this division, with the approval of the Commissioner, has had erected many new alcoves of shelving readily accessible in the upper galleries of the Patent Office, where every patent, arranged in consecutive numbers, can be quickly obtained or "pulled."

An accurate daily journal is also kept of the exhausted patent copies by means of which the condition of the whole supply is readily noted. There is a pressing need for more room in the Patent Office, especially for the safety of the records in the assignment division, where it is reported about one thousand deeds a day are received for record. These valuable records are exposed to the danger of fire, a condition that would not be tolerated in any well managed institution, and one which is a menace.

During Mr. Duell's term of office the new system of classification has been introduced, the intent of which is to grade patents into kinds or classes so that the state of the art can be readily determined. Owing, however, to the multiplicity of subjects and subdivisions and the differences of judgment among individual examiners there appears at the present time to be no special advantage in the work accomplished over the old régime. The new Commissioner will need to give the system careful study if any improvement is to be effected.

Mr. Frederick J. Allen, of Auburn, New York, has been appointed to succeed Mr. Charles H. Duell to the important position of Commissioner of Patents, and will soon assume his new duties. We trust the new Commissioner will not only maintain the present standard of work, but greatly increase its efficiency.

RUSSIAN ARMY AND MARINE.

The Russian empire, occupying as it does such a vast extent in Europe and Asia, needs for its security the greatest army now existing. The present recruiting laws permit of mobilizing, in case of war, twenty-two classes of seven hundred and fifty thousand soldiers each, or, allowing a considerable margin, at least thirteen millions. This immense army must not be considered, however, as an instructed and mobilizable corps; it may be admitted that about four million soldiers ready for the campaign could, if necessary, respond to the call of the Czar. The Emperor is the supreme chief of the army, and no parliamentary assembly has the right to question his acts. Usually, the Minister of War acts as intermediary between the Emperor and the troops, and in such capacity his authority is of the greatest. To the Ministry of War are attached the higher Council of War, the Supreme Court of Military Justice, and the Military Cabinet of the Emperor; the War Department is divided into a Chancellery and eight grand divisions: Etat Major general, intendance, artillery, engineering corps, health, military schools, Cossack troops and military justice. The military territory is divided into 12 grand departments, at the head of which are the officers bearing the title of commander-in-chief; these have the command of the troops stationed in the region, those belonging to the territory and those of the various establishments. In several of the regions, in Finland, at Wilna, Warsaw, Moscow, Kieff, in the Caucasus, in Turkestan, in Siberia, and the Amour district, the commanders-in-chief are invested with a higher political authority, and take the title of Governor-General. The distribution of the Russian troops by army corps is not uniformly established, as in some other countries of Europe. It may be admitted, however, that in European Russia 52 divisions of infantry, 52 groups of mounted artillery, 23 divisions of cavalry and 44 batteries of mounted artillery constitute 25 army corps, of which two are in the Caucasus region. Beyond the Ural, in Siberia, in Turkestan and the Amour region, and, at present, in Manchuria, the organization is variable, and depends upon circumstances.

The corps of Russian officers is recruited in a great part from the Lower Military Schools, of which there are seven for the infantry, those of Kazan, Odessa, St. Petersburg, Tchougouiev, Tiflis, Wilna and Irkoutsk; two for the cavalry, Elisabethgrad and Tver; two for the Cossacks, Novocherkask and Orenburg. The remainder of the officers come from the Body of Pages of the Emperor and the Military Schools. These latter schools are open, in principle, to young men of all classes of society, including the under-officers and private soldiers; they are located at St. Petersburg and Moscow. The preparatory instruction for these schools is obtained at twenty-four cadet schools and three preparatory schools. For the higher military instruction four Military Academies are established, the Nicolas Academy of the Etat Major, the Michel Artillery Academy, the Nicolas Engineering Academy, and the Academy of Military Law. The Russian army on a war footing is composed of five contingents of the active army, thirteen contingents of reserve and four of militia of the first class; all these troops have received the necessary instruction and have been grouped by the officers of the active army and the officers of reserve. The militia of the second class has received no military instruction. The Cossack troops, which form a unique feature of the Russian army, are recruited in a special manner, and are clothed, equipped and mounted at their own expense; the State furnishes only the arms and ammunition. The effectiveness of the Cossack troops on a war footing would exceed 250,000 cavalry.

As to the Russian Marine, it may be remarked at the outset, that Russia has but a small coast development, and it is easy to defend by means of coasting cruisers and line of torpedoes, without counting the ice, which forms during several months an impassable barrier around the Baltic ports. The entry of the Black Sea would be stopped by the fleet of modern battleships constructed on the docks of Nicolaieff and Sebastopol. For some years since, the efforts of Russia have been directed toward the extreme Orient, and the vessels which are being constructed are designed to reinforce the Pacific fleet, being thus upon the open sea; the ports of Vladivostock and Port Arthur are constantly developing, and new vessels are being constantly sent there.

The Emperor is the supreme chief of the Marine, but he delegates his powers to one of the members of the Royal Family, this being in the present case the Grand Duke Alexis. This Admiral-General, who presides over the Admiralty Council, has under his orders the Minister of the Marine. At the present time the Russian fleet has seven first-class battleships, with displacements from 8,500 to 11,000 tons; three coast-defense cruisers, of 4,000 tons; eight armored cruisers, of 6,000 to 12,700 tons; three protected cruisers of 3,000 to 5,000 tons. All these vessels are at least twenty years old; to them must be added those which form part of the Black Sea fleet, including seven battleships of 9,000 to 12,500 tons and one cruiser of 3,000 tons. Besides, a fleet of twenty destroyers, etc., and seventy-five torpedo boats is distributed between the northern and southern coasts and those of eastern Siberia. The personnel for these different vessels is made up of sailors coming from the recruitment, who remain seven years in service. These men are in general embarked upon the same vessels; they are sent to special naval schools where they complete their instruction. The under-officers come from the ranks and cannot become officers; they do not form a very compact body, and generally prefer to leave the service at the end of the seven years. The number of under-officers and marines is about 41,000. The officers must belong to the nobility or be the sons of officers of the Marine; they come from two sources, those who pass the Cadet School of the Marine and those who engage as volunteers and after eighteen months of embarkment pass a satisfactory examination. The Cadet School of St. Petersburg is established on land and has besides numerous vessels for practical exercises; the course lasts six years, after which the cadets become midshipmen. As to the officers of the Marine, these include 55 rear-admirals, 92 captains of the first class, 212 of the second class, 724 lieutenants, and 366 midshipmen. A number of special naval schools enable these to complete their instruction; some of these are of a theoretical nature, as the Nicolas Academy, devoted to astronomy, naval architecture, etc., and others practical, as the schools of marine artillery, diving, torpedoes, etc.

Russia has but one arsenal on the Baltic, that of Cronstadt. Another is being constructed at Libau, not far from the German frontier; it is called Port Alexander III., and the work has been going on since 1891. On the Black Sea are those of Nicolaieff and Sebastopol, the former of these is in the interior, on the Bug River; in the extreme Orient are Vladivostock and Port Arthur. In the Gulf of Finland are the secondary posts of Revel and Sveaborg. Besides these a certain number of state and private docks and establishments aid in the construction of the fleet; the principal of these are situated on the Neva, near St. Petersburg, and at Nicolaieff. As to the volunteer transport fleet of the Black Sea, its origin goes back to the Turco-Russian war of 1877. At this period, the government lacked transport boats, and some wealthy individuals associated together in order to purchase the necessary vessels in Germany; these, however, arrived too late to be of service on this occasion, but the institution of the volunteer fleet was kept up, and the vessels already bought were added to. At the present time they serve to transport the necessary troops and military supplies to Siberia; on the return voyage they bring back a load of freight, including tea. Besides 12 rapid transport vessels of 12,000 tons and a speed of 20 knots, this fleet possesses a number of slower vessels.

THE REMAINS OF AN OLD INDIAN VILLAGE.

Mr. J. A. Udden has recently printed the results of his investigations of the remains left by an ancient tribe of Indians of the Siouan stock who formerly inhabited a village in McPherson County, Kansas. A series of circular mounds were opened, each of them being about twenty feet in diameter, and none of them more than three feet in height. Fifteen such mounds constituted the village, and it is noteworthy that their distance apart was 125 feet or some multiple of this number. No human remains were discovered, but a quantity of domestic utensils, bones of animals, pottery, tools, arrow-heads, pipes, etc., were found. The most remarkable item was a piece of chain-armor, which is presumably of European armor, and which may have come from the expedition of Coronado, who passed through this region in 1542.

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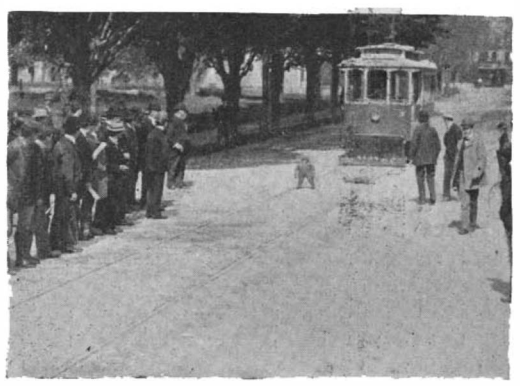
THE MUTOSCOPE AND MACHINERY IN MOTION.

It does not often happen that a device, which was originally designed as a mere toy, becomes an instrument of practical utility in the great world of commerce. Occasionally it does, as in the case of the bicycle, which, in the form of its natural ancestor, the "hobby-horse," was a toy of the most rudimentary description, but in its modern development is a machine of the highest general utility.

It is the purpose of the present article to describe an instrument which is undergoing a similar change by enlarging its field of usefulness from that of a mere instrument of entertainment to one of commercial utility. Our readers are familiar with the mutoscope, which has been aptly described as "the little brother of the biograph." It is a simple and ingenious contrivance for the exhibition in a cabinet of the same moving pictures that the larger machine throws life-size upon a screen. It is not necessary to give here any detailed account of this well-known machine, and those who wish to learn fully about the construction and operation of the biograph and an earlier form of the mutoscope are referred to the Scientific American of April 17, 1897, which contains a fully illustrated article on the subject.

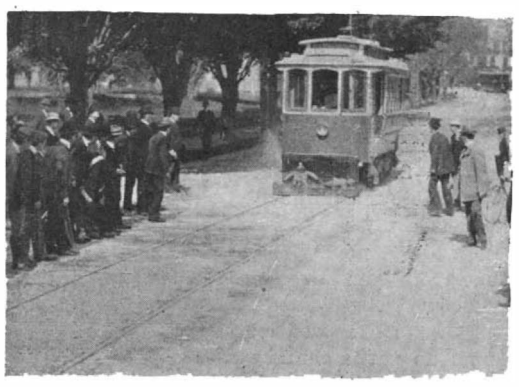
Now, the art of moving photography, as we have said, has hitherto been solely devoted to the purposes of entertainment. In the case of the biograph, the subject is thrown upon a large screen hung on the stage of the theater, and in the mutoscope the photographs are set up in circular book form, within a suitable box or case, and successively tripped before the eye by means of a hand-crank or electric motor. In each case the subjects chosen for exhibition have usually been selected for their scenic or spectacular effect, and with certainly no thought to their commercial utility.

It was inevitable, however, that the great possibilities of this little machine in a commercial or industrial way should early suggest themselves. If it is possible to reproduce a train in motion, to catch the discharge of a rifled gun at Sandy Hook, or the rush of the whirlpool rapids at Niagara, why should not the mutoscope be harnessed to the service of industry, and made to show machinery in motion and recall to prospective purchasers the operation of complicated devices? There is an old saying that "seeing is believing," and while a good line drawing, or a judiciously taken photograph, will do much to bring a subject before the mind, the actual movement is lacking and may very easily be misunderstood. At present there is an endless number of commodities that cannot be sold from samples; such, for instance, as locomotives, cars, derricks, pile-drivers, and all heavy machinery, revolving doors, fire-escapes and extinguishers, blasting powder and an ever-increasing list of etceteras. Some of these devices are portable; but it is not enough to show them to the prospective customer—he must see how they work. This, however, if often impossible, for the man with a fire extinguisher or escape cannot start a blaze to order, nor can a blast of giant powder be set off at the nearest street corner to demonstrate its disruptive value. Moreover, there are many large operations, such as systems of transportation of the raw materials from mines to mills and factories, of which no mere verbal or written description conveys an adequate idea, and for which some system of continuous illustration is necessary to render it intelligible. With a view to enabling the inventor, the promoter, or the salesman, to show, as well as explain, the operation of devices which are too elaborate or too cumbersome to admit of a model or a portable sample being carried round, the makers of the biograph and mutoscope have produced the compact instrument shown in the accompanying illustrations, to which they have given the self-explanatory name of "Commercial Mutoscope." It will be recognized as an improved slot-machine mutoscope, with the stand and slot-mechanism removed, and its bulk and weight so reduced that it is as conveniently portable as a photographer's camera, or an ordinary sample case.

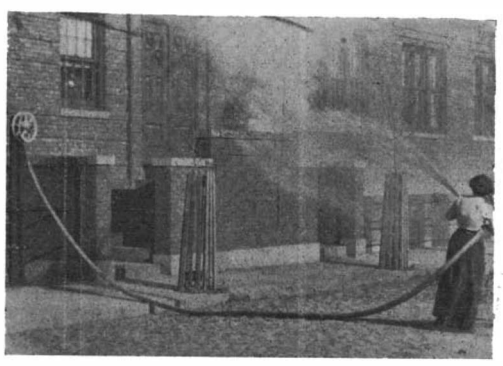


CAR APPROACHING DUMMIES.

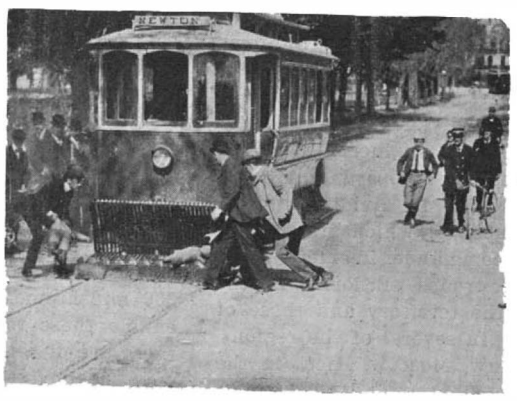
UNREELING THE HOSE.



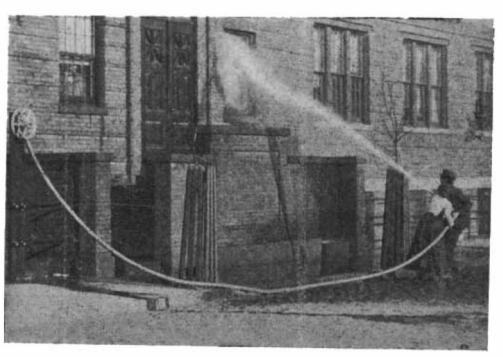
DUMMIES PICKED UP.



WATER TURNED ON.



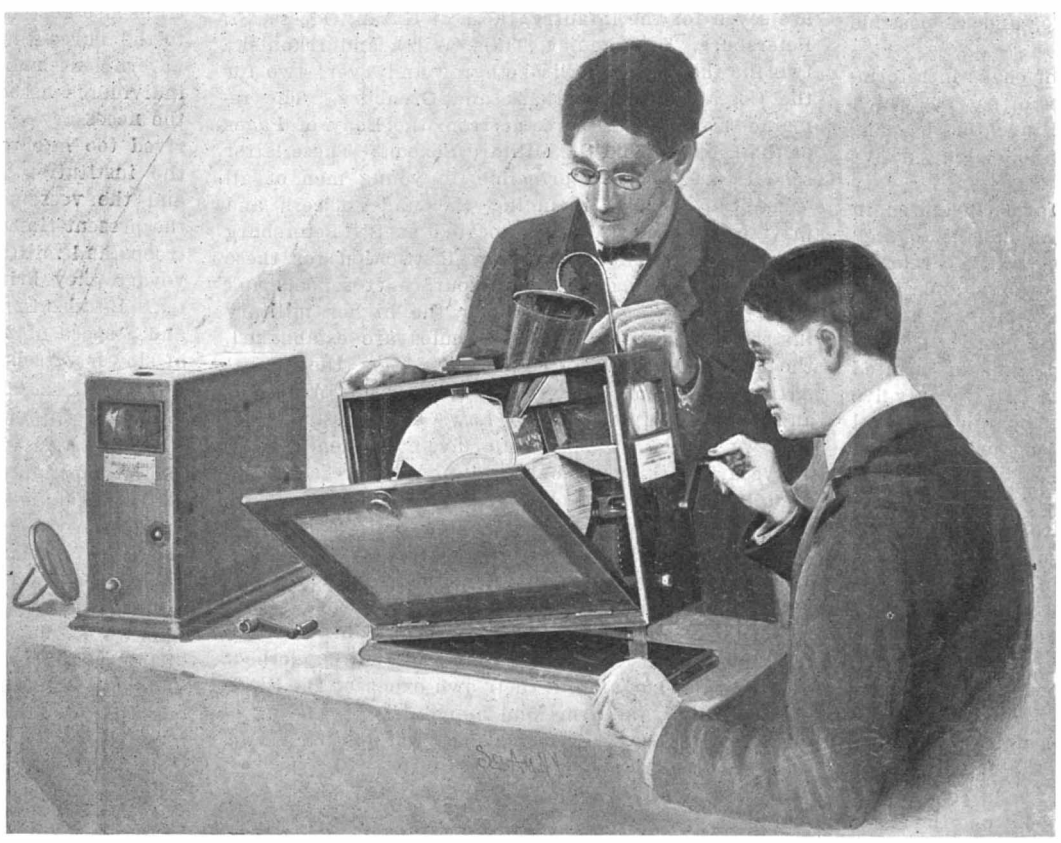
REMOVING DUMMIES FROM THE FENDER.



FIRE OUT IN 30 SECONDS.

Selection of Views from two 180-foot strips of Mutoscope films.

Of our illustrations, one shows the cabinet open, with the circular book of photographs removed, and another represents the mutoscope in operation, and also closed with the mirror and turning-crank removed. The photographs of objects in motion are taken upon a moving film at the rate of forty per second. These are reproduced upon cards which are mounted radially in consecutive order around a hollow cylinder, and stand out like the leaves of a book (see illustration). The cylindrical book is placed upon a small shaft arranged centrally and transversely within the cabinet. On the same shaft is mounted a worm wheel, which is engaged by a worm on a shaft that is carried near the right-hand wall of the mutoscope. When the cylinder is slowly revolved, the picture-cards being held back by a stop, (carried in the position shown), and allowed to sweep past the eye one by one, as one thumbs the leaves of a book, an apparently moving picture is the result, and the exact motions of the device are reproduced. One great advantage is the ability of the operator to vary the speed; for he may make the operation quick or slow as he desires, either maintaining the normal speed at which the original demonstration took place, or stopping the spectacle at any point in the series, so as to inspect each picture step by step at his leisure. The case containing the mutoscope is hinged at its forward end to a base plate, and by means of a vertical rack extending from the front end of the box the machine may be inclined to suit the convenience of the user.



THE COMMERCIAL MUTOSCOPE.

As an instrument for the exploitation of newly patented inventions, this machine should have a wide field of usefulness. We present a series of taree pictures of a new style of car-fender. Life size dummies of children were placed in front of a moving car and the biograph camera took a roll of pictures (from which these three were selected) as the fender successfully picked up the objects. Another group of pictures shows a woman in the act of unrolling a reel of hose and throwing a stream of water into a blazing cottage. There are on view at the office of the Mutoscope Company series of pictures showing the operation of heavy machinery, cars, etc. One of the best of these represents a well-known hoisting and conveying machine in operation. It can be understood that in commending this machine to the favorable consideration of the manager of a railroad, or a steamship company, the vendor would be at an immense advantage if he could place his mutoscope cabinet on the desk and let the official take the crank in his own hand and vary the "ocular demonstration" to suit his own idiosyncrasies.

We are indebted for our photographs and information to the courtesy of the American Mutoscope and Biograph Company, of 841 Broadway, New York, whose studio and factory afford impressive evidence of the growth and future promise of the essentially modern art of moving photography.

Experiments have been carried out in England to ascertain the amount of corrosion that takes place upon the plates of a ship under varying conditions regarding water, weather, etc. Iron and steel plates were immersed in sea water, river water, and also exposed to the weather, but very little difference was found to occur in the relative corrosion of the two metals. When an addition of 3 per cent of nickel was introduced into the steel the rate of oxidation diminished by about 23 per cent, and when the steel was mixed with 26 per cent of nickel the loss by oxidation was equal to about 33 per cent of that of wrought iron.

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THE TOPOPHONE.

Fogs are unquestionably the greatest menace to the mariner. When he can see a danger he has a chance to avoid it, but in a fog all he knows positively is the direction of his vessel as given him by the compass; as to the direction of warning sound signals, he has to depend on his unaided hearing. Now this is notoriously uncertain—the sense of hearing, so far as direction is concerned, is very defective even when assisted by the eyesight; witness the performance of a ventriloquist who does all the talking for several manikins on different parts of a stage. To the spectator it will seem as if the sounds proceed from the manikins, while, as a matter of fact, it is the performer who makes the sounds, and it is the spectator's imagination which gives the direction.

It is not improbable that it is also the imagination which frequently deceives the mariner. He knows, or thinks he knows, that a certain fog signal should be heard in a certain direction; he is listening for it, and when he hears it his preconceived opinion biases his judgment.

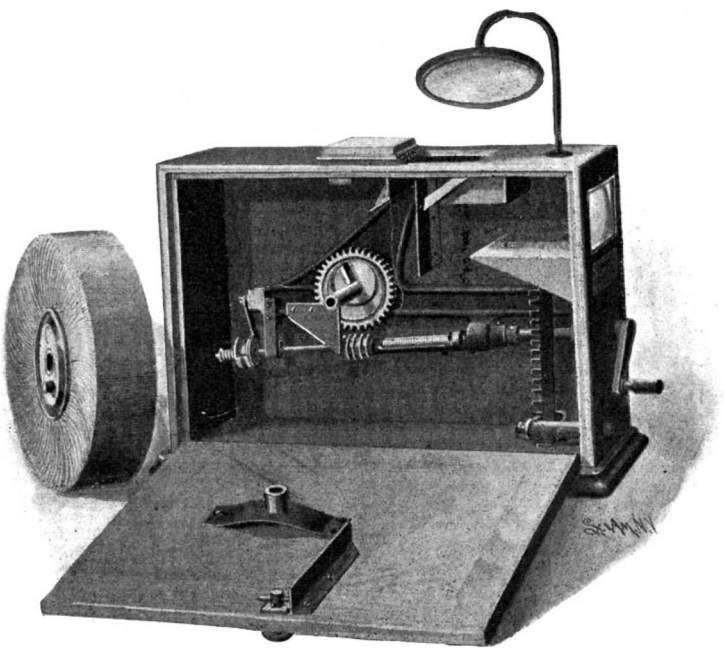
Various attempts have been made, especially of late years, to invent devices which will assist the mariner to locate his position in a fog. Fog signals themselves have been improved so as to give the sound a greater penetrating power, and wireless telegraphy and the late Prof. Elisha Gray's method of ringing bells under water have been pressed into service. The Hamilton-Foster fog-signal, which gives a distinctive blast according to the direction the fog-horn is pointed, may also be cited. All of these need special appliances, either on shore or on the vessel, or on both, to make them of any use, and all of them are so expensive as to debar their general introduction. Besides, with the exception of the Hamilton-Foster fog-signal, although a sound or a signal may be heard, its direction is not given. If the mariner knows the direction of any signal, in addition to the course of his vessel, he will be greatly assisted in keeping out of danger.

The United States government has established 393 fog-signals, 120 bell buoys, 73 whistling buoys, and 44 light-vessels with fog-signals on or near the shores of its navigable waters. Other nations have similarly guarded their coasts. Every vessel that floats is required by law to carry some kind of a fog signal. In addition, there are other sounds, such as echoes, breakers, etc., whose direction the mariner needs to know to prevent accident. The topophone has been devised to accomplish just this thing, and also to hear sounds at greater distances than is possible with the unassisted ear. With its use the mariner can determine the direction of any sound before it can be heard without the instrument. The topophone is simple in construction, light in weight, portable, can be used in any part of a vessel, and any one with normal hearing can soon become proficient in its use.

It consists of two acoustic receivers or trumpets, pointing in opposite directions and supported on a vertical shaft—see Fig. 1. From the lower ends of the trumpets extend rubber tubes connected with the ears by specially constructed ear pieces. The observer holds the shaft so that the instrument is above his head; if a sound is heard in either ear—the right ear, for example—it shows at once that the sound must be somewhere on his right-hand side. If he then turns to the right until the sound is heard in his left ear, it shows that he has passed the direction of the sound. If he then oscillates the trumpets so that the sound is heard alternately in each ear, the sound will be in a direction inside the angle of oscillation; this angle generally is about one point of the compass. The whole operation is simple, and the above operations take but a few seconds.

As soon as the direction of the sound is ascertained, the observer can keep the topophone pointed in its direction, and, knowing the speed of the vessel and its course, the location of the sound can be quickly plotted accurately enough for all practical purposes. For example: Suppose the observer locates the direction of the fog signal at Beaver Tail, at first as due north—see Fig. 3 (*A*)—that the vessel's course is NE ¼ E, and that after the vessel has gone one and a half miles the direction of the signal is west, by a very simple calculation it will be known that when the vessel was at *A* it was about one mile, and when at *B* about one and one-eighth miles from the fog-signal. If the directions of the fog-signals at Beaver Tail and at Brenton Reef Light-Vessel are determined by the topophone, the location of the vessel can at once be plotted. The topophone is the invention of Lieutenant-Colonel D. P. Heap, engineer of the Third Light-House District, Tompkinsville, N. Y.

Prof. Mayer, of the Institute of Technology, Hoboken, N. J., invented an instrument to determine the direction of sound to which he also gave the name "topophone."



SIDE DOOR OF MUTOSCOPE LOWERED, BOOK OF PICTURES REMOVED TO SHOW TURNING GEAR

The following is the description of it, taken from the SCIENTIFIC AMERICAN SUPPLEMENT of July 4, 1885:

"Briefly described, the topophone consists of two resonators (or any other sound receivers) attached to a connecting bar or shoulder rest. The sound receivers are joined by flexible tubes, which unite for part of their length, and from which ear tubes proceed. One tube, it will be observed, carries a telescopic device by which its length can be varied.

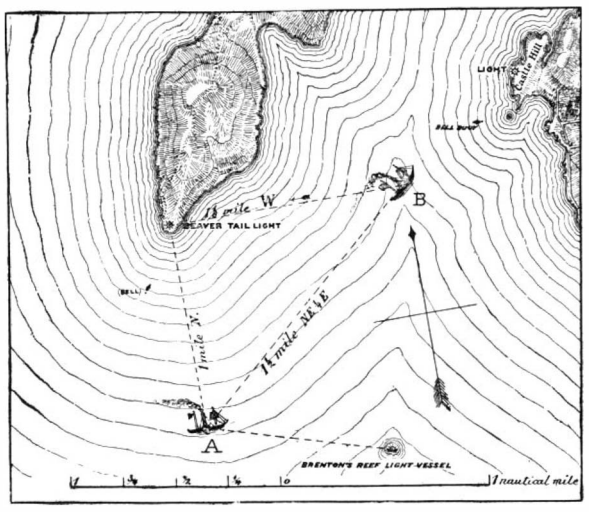


Fig. 3.—DIAGRAM SHOWING USE OF TOPOPHONE.

When the two resonators face the direction whence a sound comes, so as to receive simultaneously the same sonorous impulse, and are joined by tubes of equal length, the sound waves received from them will necessarily re-enforce each other, and the sound will be augmented. If, on the contrary, the resonators being in the same position as regards the source of sound, the resonator tubes differ in length by half the wave length of the sound, the impulse from the one neutralizes that from the other, and the sound is obliterated.

"Accordingly, in determining the direction of the source of any sound within this instrument, the observer, guided by the varying intensity of the sound transmitted by the resonators, turns until their openings touch the same sound waves simultaneously, which position he recognizes either by the great augmentation of the sound (when the tube lengths are equal) or by the cessation of sound, when the tubes vary so that the interference of the sound waves is perfect. In either case the determination of the direction of the source of the sound is almost instantaneous, and the two methods may be successively employed as checks upon each other's report."

Prof. Henry Morton, of the same Institute, experimenting with this instrument, says:

If the surface of a sound wave were always truly spherical, this instrument might locate its direction with a fair degree of accuracy, but this surface is frequently deformed, sometimes to the extent of being a curve of double curvature, and in such a case the instrument would be fatally misleading.

In addition, it is necessary that all fog-signals should be tuned to one note to make this instrument effective, as it will not locate any sound not tuned in unison with it.

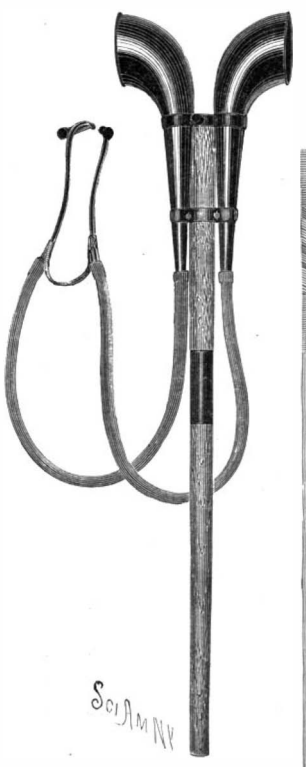


Fig. 1.—HEAP'S TOPOPHONE.

Fig. 2.—THE TOPOPHONE IN USE.

A Tunnel to the Isle of Wight.

The bringing of the Isle of Wight, off the coast of Hampshire, into closer communication with the mainland by the construction of a submarine tunnel has been proposed. The idea is by no means an original one, since it was first suggested over fifteen years ago. The scheme, at that time, was to construct a tunnel beneath the Solent, from Start Point, on the English coast, to Cowes, the yachting center on the Isle of Wight. It was, however, abandoned, principally owing to the many engineering difficulties that would have been encountered, the most serious of which was the provision of a suitable approach to the tunnel at Cowes, owing to the abrupt descent which the shore makes into the water.

The present idea, however, is to penetrate the bed of the Solent, near Hurst Castle, and to emerge upon the island at Totland Bay, near the Needles. The channel at this point is two miles in width, and the preliminary surveys have revealed the fact that the soil through which the tunnel will extend is favorable to the rapid completion of the work, so that no unusual engineering difficulties will be experienced. By this means the island, which is only accessible at the present time by steamboat lines, will be brought into close and rapid communication with the main trunk railroad in the south of England, and will thus be a valuable means of developing the island.

The enterprise is well supported financially, and the application for the necessary powers will be made during the coming Parliamentary session. It is estimated that the total cost of the project will amount to $3,750,000, and that it can be completed within two and a half years. It is proposed to construct a railway branching off trunk line of the London and South-Western Railroad at Brockenhurst, near Bournemouth, to a point on the coast of the Solent, somewhat north of Hurst Castle. This latter is really a range of buildings used principally as a Lloyd's signaling station for the mail steamers passing to and from Southampton, and is located at the end of a pebbly spit of land jutting out into the Channel somewhat similar to the Chesil Beach off Portland. The country is level at this part, so that no elaborate excavation will be necessary to construct the approach to the tunnel, the gradient of which will be gradual, since the bed of the Solent at this point has a gentle shelve. The first section of the tunnel will be constructed of circular iron plates, similar to the Central London Electric Railway, only of larger dimensions. This method has been suggested as offering the best resistance to possible scouring. When the tunnel has penetrated well beneath the sea bed it will be constructed of brick. On the island the tunnel will emerge up a gradual slope similar to that on the English shore. The total length of the tunnel and necessary approaches is to be seven miles, and the journey beneath the Solent will only occupy five minutes at the most. The line will be continued inland to Freshwater, where a junction will be effected with the insular railway system.

The construction of this tunnel will be instrumental in bringing the principal towns of the island within two and a quarter hours' railway traveling from London, whereas with the present facilities the journey occupies from three and a half to five hours. It will

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also enable the goods traffic to be carried on more expeditiously than it is under the existing circumstances.

When the Channel Tunnel was projected with a view to connecting Dover on the English mainland with Calais on the French coast, the British War Office vigorously opposed the scheme, on the grounds of national defense. In this instance, however, it is anticipated that the military authorities will support the scheme, since it will enable them to transfer their troops from the military camp at Aldershot, which is also upon the main line of the London and South-Western Railroad, to the island, if the exigency arose, within three hours. Near the island entrance to the tunnel exist a number of modern forts, to guard the entrance to the Solent, and in case of war troops could be concentrated at this point with the utmost celerity. The military authorities have been seriously considering the advisability of strengthening the defenses of this island, which at present is in a very vulnerable condition, so that the construction of this railroad would probably facilitate the work of the military department. At any rate, it is not at all probable that they will offer any opposition to the enterprise.

THE INTERNATIONAL RACING-YACHT "INDEPENDENCE"

The very liberal policy which is being pursued by Mr. Thomas W. Lawson, the owner, and Mr. B. B. Crowninshield, the designer, of the 90-foot racing yacht, which is now under construction in Boston, for the defense of the "America" Cup, comes in pleasing contrast to the secrecy which of late years has surrounded the design and construction of challenging and defending yachts on their respective sides of the water. The illustrations of the "Independence" on the front page of this issue are made from photographs taken in the shed where the yacht is being built, and from the working drawings, blue prints of which were kindly furnished from the designer's office. The dimension of the boat are as follows: Length over all, 140 feet 10½ inches; length on water line, 90 feet; overhang forward, 27 feet 5½ inches; overhang aft, 23 feet 5 inches; beam, extreme, 23 feet 11½ inches; beam at water line, 23 feet 5 inches; draft, extreme, 20 feet; freeboard at stemhead, 6 feet 11 inches; freeboard at taffrail, 4 feet 8 inches; freeboard, least, 4 feet; deck beam at forward end of water line, 15 feet; deck beam at after end of water line, 18 feet 9 inches; beam at taffrail, 11 feet 8 inches; area of lateral plane, 772.6 feet; area of midship section, 117.9 feet; area of L. W. L. plane, 1,771.5 feet; wetted surface, with small rudder, 2,913.5 feet; with large rudder, 2,956 feet; displacement, 146.75 tons.

Assuming that the new defender which Herreshoff is building will be an improved "Columbia," as "Columbia" was an improved "Defender," it is interesting, with the plans of the Lawson boat before us, to compare the points of difference between "Independence" and "Columbia." In the first place, comparing the midship section, the "Independence" has a harder bilge, a flatter floor and the curve at the garboards is of much smaller radius; in these respects, indeed, she is not unlike the "Shamrock." As we leave the midship section, the difference between "Independence" and "Columbia" becomes very marked. In the "Columbia" the bilges begin to ease away rapidly toward the bow until at the forward end of the water line the cross section of the bow approximates a blunt V form, thus giving a sharp and easy entrance and water lines that do not lengthen much as the boat heels to a breeze. Aft of the midship section the run and quarters of the "Columbia" are remarkably fine and easy, and although in a breeze she lengthens her water line almost to the taffrail, the form is such that there is but little perceptible drag, or quartering wave, when the vessel is reaching in a strong breeze. The characteristics of "Independence" are her extremely long overhangs, giving her an overall length fully 10 feet greater than that of any previous cup defender. Coupled with this great length is the fact that she carries her hard bilges and flat floor well out beyond the normal 90-foot mark, both forward and aft, thus providing an extremely long, flat floor and a great gain in water-line length when the boat is heeled. With this form of hull it is possible to carry a maximum amount of sail with a minimum amount of ballast, and as a matter of fact "Independence" will carry only 75 tons of lead in her keel as against the 85 to 90 tons which are generally credited to the "Defender" and "Columbia."

Perhaps the best idea of the full bow and stern sections and natural sail-carrying power of the yacht is derived from a consideration of the load-water-line plane as shown on the accompanying plan, and the photographic views of the interior of the hull looking toward the bow and toward the stern from the mast-step. Here it will be seen how the flat floor extends practically the whole length of the yacht, the hard curves at the bilges being maintained well into the bow, and carried out to the 79th or last frame, as shown in the cross-section of the hull at this point. Although there will be a certain bluffness in the bows it must be admitted that once entrance has been made, the lines of the yacht will be such as not merely to provide great sail-carrying power, but a form which will lend itself to high speed. Even when driven to the limit, the "Independence" should leave a wonderfully smooth wake behind her. It will be noticed that two rudders are provided; the after rudder will be used in place of the forward one, if the sailing trials prove that its more powerful control is necessary.

Considered from a structural standpoint, the new yacht shows how the principles of framed structures, as used by the engineer in bridge building, are being applied to yacht construction. The peculiar model of "Independence," with her great overhangs and shallow depth, renders the task of meeting and distributing the intense local strains which are set up in the structure of such an extreme racing yacht most difficult. For instance, it will be noticed that the mast is stepped fully 10 feet forward of the stem and at a point where the molded depth of the boat is not more than 4 feet and the draft 2 feet. Upon the thin bronze bottom of the boat, which at this point is less than ¼ of an inch in thickness, is to be carried the enormous vertical load of the mast with its towering structure of spars, canvas and rigging, a load which is intensified by many tons when the vessel is heeled to a breeze, and the vertical component of the pull of the shrouds is added to the normal dead-load of the mast. This vertical thrust is met by interposing between the heel of the mast and the plating of the hull a deep, cellular structure of steel plates, which measures 12 feet in width by 14 feet in length, and is 2½ feet deep at the center. This structure is riveted upon the frail floor of the boat, and serves to distribute the load of the mast throughout the surrounding framework of the hull. Associated with the mast foundation is a series of four, special, transverse, deck-beams, extending across the deck in the wake of the mast, which are in reality bowstring trusses, 17 inches in depth at the center, of great vertical stiffness. From the bottom of these trusses a number of ⅞ inch steel tie-rods are carried down through the steel ring which forms the step of the mast and secured by knots below the bottom face of the same, thereby transmitting a portion of the mast load directly to these deck beams. Moreover, it will be seen from the transverse section of the boat at the mast-step that the special deck beams above mentioned and the mast-step framing are connected by a system of trussing, composed of 2⅜-inch hollow steel struts and 3 by 3-inch angles. As the transverse strains which are set up at this point in a racing yacht when she is being pressed to the utmost in a strong breeze are enormous, not only is there the great downward thrust of the mast as above explained, but there is the upward pull of the shrouds on the side of the boat which in itself will run up to the total of a great many tons. The deep deck beams and the cellular structure of the mast step, with the triangular bracing of the angles and struts, together constitute a true bridge structure, admirably adapted to take care of the intensified local stresses at this point, and distribute them over a broad area of the delicate shell of the yacht.

Another interesting study is the provision made for giving the necessary longitudinal strength to the long, overhanging bow and stern of "Independence." It will be noticed that there is a deep, vertical keel-plate which varies from a depth of 9 inches at the bow to 18 inches at the point where the fin keel commences. At the center line of the deck there is also a horizontal steel plate of the average width of 18 inches associated with the vertical plate which is from 6 to 8 inches in depth. Between these two members, which might be called the top and bottom chords, there is worked in a system of tie-rod bracing and vertical, hollow, steel struts, the rods varying from ⅞ of an inch to one inch in diameter and the struts from 1½ inches to 2 inches in diameter. This construction provides what is practically a deep steel truss which extends from the stiffened framing at the mast out to the end of the overhanging bow. The necessity of trussing of this kind will be appreciated by those of us who remember what happened to the over lightly built bows of the 70-footers of last season, which, yielding to the enormous upward pull of the head stay and topmast stay, were drawn upward out of their proper line from 12 to 14 inches. The after overhang, it will be noticed, is similarly trussed, the tie-rod bracing, however, running only in one direction—being put in, doubtless, to assist in carrying the weight of the crew, when it is massed toward the taffrail to keep the bow of the boat up when she is running before the wind. The hull is further stiffened by four lines of stringers, two on each side, with 2-inch tubular struts, extending from the stringers to the deck beams.

There are 79 frames in the yacht, spaced about 2½ feet apart. The frames consist of nickel-steel angle bulbs. The plating of the hull is of bronze from the keel to the sheer strake, which latter is of steel. From amidships to a little forward of the mast the sheer strake is 9-32 of an inch in thickness, while from forward of the mast to the bow it is ¼ of an inch, and from amidships to the stern it is ¼ and 3-16 of an inch in thickness. From the garboard strake to the sheer strake the bronze plating is 7-32 of an inch and ¼ of an inch in thickness amidships and 3-16 of an inch thick forward and aft. From the garboard strake to the bottom of the keel the bronze plating is ¼ of an inch and 5-16 of an inch in thickness, while the bottom plate of the keel is a bronze casting ⅝ of an inch in thickness. In constructing the yacht the keel was first built up and riveted, and then pig lead, with shot to fill up the interstices, was stowed, until 62 tons of the same was in place. Molten lead was then run over the top, to form a crust, and keep it in place. After the yacht is afloat, about 13 tons of pig lead will be stowed above this until the vessel has reached the desired trim. The deck beams are angle bulbs of the same weight as the frames. The deck plating is of steel and aluminium, distributed as follows: Continuous steel side stringers run from stem to stern, and vary in diameter from 3-16 by 10 inches at the ends, to ¼ inch by 2 feet in width amidships. There is also the longitudinal centerline steel plate, already referred to, which varies from ¼ inch by 2 feet amidships to 3-16 of an inch by 1 foot in the ends. The deck is covered with 3-16 of an inch steel plating for a distance of 10 feet forward and aft of the mast. The rest of the deck is plated with aluminium. As the displacement of "Independence" is given as 146¾ tons and the total lead ballast will amount to about 75 tons, it is fair to presume that the total weight of the hull, spars, rigging, sails, stores and crew, when the boat is down to her 90-foot water line, will be about 72 tons.

There can be no question of the great originality and skill with which the construction of this interesting boat has been worked out. The peculiarity of her form, her great sail-carrying capacity, involve that she will be put to severer strains than any yacht of her size that has yet been launched; and we think that the designer is to be congratulated upon the success with which he has combined lightness and strength in producing a powerful form. Had the "Independence" been built upon what might be called the commonly-accepted lines of a 90-footer, and had there been less originality shown in the design, there would not be the great public interest attending her trials against the Herreshoff boat which is now certain to be manifested.

Electric Wind-Registering Apparatus.

A new apparatus for registering the direction of the wind is in use at the observatory of the Agronomical College, at Berlin, which permits of registering eight directions of air-currents by electrical means, using but two pendulums, each provided with a stylus. The apparatus carries at the top a vane of the usual type, carried upon a rod which passes below and has on its lower end a metal sector which may rub over four contacts placed at the corners of the platform carrying the pivot of the rod. The dimensions of the sector are calculated so that it may touch but a single contact or two adjacent contacts. The movable sector is connected to one of the poles of a battery. Each of the four contacts has a wire which passes to the coil of an electro-magnet and the four magnets are placed horizontally so that between each of the two pairs of coils oscillates a pendulum carrying the ink stylus. The other ends of the coils are connected with the other pole of the battery. With this arrangement each of the two pendulums will be attracted to the right or to the left according as one or the other contact is touched by the revolving sector; if the sector touches two contacts at once the two pendulums will be attracted either in the same or contrary directions. If the contacts 1, 2, 3, 4 correspond to the directions N., S., E., W., of the compass, suppose that the pendulum I. is deviated to the left by contact 1 and to the right by contact 4, while pendulum II. is deviated to the right by contact 2 and to the left by 3. Under these conditions a left deflection of the pendulum I. alone indicates N.; while the same deflection, combined with that of pendulum II. to the right, indicates N. E., etc. If the indications are to be given at regular intervals, the wire from the coils to the battery passes through a relay and clock mechanism by which the circuit is closed at periods of 5 or 10 minutes, etc. The current required to work the apparatus is very small.

The famous statue of Voltaire, by Houdon, is probably the most important art object displayed in the Théâtre Français. The fire in the theatre last year excited great alarm for the safety of this precious souvenir of the French stage. The architect of the new building has designed means by which, in case of emergencies, the statue can be moved out of danger. A series of wheels has been arranged under the pedestal so that the mass can be moved with as much ease as if it stood on a trolley.

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Science Notes.

The meteorite which fell at Porto Alegre, Brazil, has now been measured, and the results are most astonishing. It measures 56 feet from the base and is 85 feet high.

German towns are increasing rapidly in population. In five years Posen has increased 58.6 per cent; Berlin has now 1,884,345 inhabitants; Hamburg, 704,669; Munich, 498,503; Leipzic, 455,120.

William Couper, the sculptor, is engaged in modeling a heroic portrait-bust of the late Prof. Thomas Egleston, and funds are being collected for this memorial to the founder of the School of Mines of Columbia University.

A marked rise in the level of the Dead Sea has been noted. A broad lagoon has been formed on the north side of the Jordan delta. The water does not sink in summer, and it is surmised that the whole bottom of the Dead Sea has been raised by volcanic action.

A London dealer in physical apparatus, etc., offers for sale a strictly limited number of vacuum tubes, containing neon, krypton and xenon. Also tubes of argon and helium. They cost from one to three pounds each without quartz ends, and the whole set of five gases, with quartz ends, costs about $100.

At a recent Headmasters' Conference held in England, a committee was appointed to take up the study of archæology in schools and the foundation of an archæological museum. It was thought that the more extended study of this science would quicken the students' imagination of the lives of men who made classical history and literature.

Berlin has refused a legacy of $120,000 for an orphan asylum, as one of the conditions of the bequest was that the orphans should be brought up on a vegetarian diet. Those who are making bequests should not thrust their fads on institutions, and Berlin is to be commended, as Breslau is to be condemned, in this matter, as the latter city expressed a willingness to accept the gift with the conditions imposed.

The latest issue of The Geographical Journal contains a most interesting account of the results of Mr. Moore's recent expedition to Lake Tanganyika and the regions to the northward. Mr. Moore brings forward additional arguments in favor of the marine origin of the fauna of this lake (which includes shells of a marine type and a jelly fish); and from the absence of a similar assemblage of animals in the more northern lakes, he is led to conclude that Tanganyika communicated with the ocean by way of the Congo Basin, and not through the Nile Valley.

In a paper printed in The American Journal of Insanity Mr. G. Styles presents statistics regarding the occurrence of suicides. Forty years ago it was shown that only 4 out of 10,000 persons rated as paupers died by their own hands, while 7 coachmen or other servants, 5 bankers or professional men, nearly 8 soldiers, 7 tailors, shoemakers or bakers, and only 1 3-10 carpenters, butchers and masons out of 10,000 were suicides. Sweden had the lowest average of all the countries considered, namely, 1 suicide to 92,000 persons; Russia had 1 to 35,000; the United States 1 to 15,000; Saxony 1 to 8,446. In St. Petersburg and in London the proportion was 1 to 21,000. If we take the statistics of the fifty years just passed for France the following results: For every 100,000 inhabitants of France there were in 1841-45, nine suicides; in 1846-50, ten; in 1861-70, thirteen; in 1871-75, fifteen; in 1876-80, seventeen; in 1889 alone, twenty-one; in 1893, twenty-two; in 1894, twenty-six. During the years 1826-1890 the percentage of suicides increased in Belgium 72 per cent; in Prussia, 411 per cent; in Austria, 238 per cent; in France, 318 per cent; in Saxony, 212 per cent; in Sweden, 72 per cent; in Denmark, 35 per cent.

The third series of reports to the Malaria Committee of the Royal Society has just been issued, and contains the results of observations made by Drs. Stephens and Christophers on the west coast of Africa, and by Dr. Daniels in East Africa, says Knowledge. The two former write that it cannot be too clearly realized by Europeans living in the large towns of West Africa that they are dwelling amid thousands of cases of malaria, rendered the less dangerous from the fact that the natives and children suffering from the disease do not exhibit the usual signs of fever. "Malaria is essentially a contagious disease, the contagion being conveyed by the mosquito; the laity must appreciate this fact and realize that to dwell in the midst of contagion, they must realize that malarial fever is a contagious disease conveyed (through the medium of the mosquito) from the native child. Malarial fever, we are convinced, is best avoided most readily by avoiding the cause of contamination, and living as far removed as possible from native huts. . . . The adult native possesses an acquired immunity against malaria, and though living under the same conditions as the children, constantly subject to the bites of infected Anopheles, yet examination of the blood shows that parasites are always absen

Electrical Notes.

McGill University, Montreal, has recently installed two large electric furnaces, taking a current of 100 amperes at 110 volts.

Marconi has sent wireless messages 200 miles from St. Catherine's to the Lizard. Perfect communication has been established between these points.

A submarine electric arc light will soon be experimented with to aid in the sponge fishery off the coast of Florida. At present, the sponges are obtained only from a comparatively small depth, as the sponge fishers at present can only see to a limited distance by the aid of a water glass, and if this distance could be increased, larger areas would immediately be opened up where sponges have been growing unmolested for years.

A new electric fire alarm consists of a metallic case containing a charge of a Bengal light surmounted by an igniting charge in which is buried an electric fuse. The whole is made water-tight, and is arranged to be put in position on a cornice or other prominent part of the building. The fuse is connected through thermostats to the battery. When the temperature rises unduly the circuit is closed, the igniting charge is exploded and the compound is ignited, making a brilliant light in the neighborhood. A device of this kind will doubtless prove of considerable value in sparsely-settled districts where there is no fire alarm system.

There have been many prosecutions in New York recently under a new law which provides for the punishment of theft of gas or electricity. The law is very comprehensive, and provides for the tapping of supplies without passing through the meter or other instrument provided for registering the quantity consumed, and for the obstruction or injury to a meter. Until this law was passed the electric companies knew perfectly well that they were being robbed, but found no way of punishing in any adequate way those responsible. Several offenders have been convicted, and one of them was sentenced to pay a fine of $150 or spend sixty days in prison. A number of Chinese laundries were found where the meter had been bridged so that their bills were only about half what they should be, and nine of the laundrymen were arrested.

Now that the Behr monorail scheme between Liverpool and Manchester has been rejected by the English Parliament, it is proposed to connect the two cities by an electric tramway. There will be 84 miles of lines communicating with all the principal towns en route, and forming junctions with other tramway systems. In view of the densely populated nature of the districts through which the tramway will extend, a heavy and remunerative passenger traffic is assured. Then again, owing to the number of manufactories in the area served by the tramway, it is anticipated that considerable revenue will accrue from the carrying of freight, which will be conveyed cheaper by this means than by any other, and also from the supply of electrical power. The undertaking is being developed by the South Lancashire Electric Traction and Power Company, Limited, and the capital required to establish the enterprise will amount to about $7,500,000.

A determined attempt is to be made in England to prove the capabilities of Marconi's wireless telegraphy for the prevention of disasters at sea. The experiments are being conducted under the auspices of the Board of Trade, Lloyds', the Trinity House Corporation, and several other institutions interested in maritime affairs. A mast thirty feet in height has been erected upon the pier at Southend, which town is situated at the mouth of the Thames. At the top of this pole is fitted a metallic conductor, which is connected with the usual instruments arranged in the pavilion. The apparatus is entirely automatic in its action, thus dispensing with the constant attendance of an operator. The vessels are each supplied with a bell, connected to a receiving instrument, which is actuated directly the ship enters the zone of influence of the shore apparatus, which in this case is a distance of seven miles. By this means the captain of the vessel receives ample warning of the danger he is approaching, since the bell continues ringing until he has once more passed beyond the sphere of influence. It is also intended that the shore apparatus shall transmit the nature and name of the danger spot to which it is attached, be it a sandbank, rock, or submerged wreck, so that the captain of the vessel is able to retain his bearings. If necessary, messages may be transmitted between the station and the vessel, since at the shore station it is only necessary to raise the transmitting wheel containing the name of the danger spot, and to actuate the apparatus in the usual manner. It is anticipated that the installation of such apparatus along both banks at the mouth of the Thames will be of inestimable value, especially during foggy weather, when the navigation of the river, which is difficult under normal conditions, is often rendered impossible, and strange vessels have to wait at the estuary, often for days at a time, until the fog has sufficiently cleared to enable them to make their way up the river to their desired destination.

Automobile News.

The Automobile Club of America has been notified by Col. John J. Astor that at least one of the proposed country houses on the road between New York and Albany will be ready this season. The house which Col. Astor has offered to place at the disposal of the club, without expense to them, is "The Maples," which forms a part of Col. Astor's Ferncliffe estate. It will be fitted up in the best manner for the requirements of the club.

King Leopold II. of Belgium is an ardent lover of the sport, and takes a keen interest in the development of the automobile in that country. He has decided to improve the roads, which in some parts of the kingdom are in a very bad state, and has charged one of the government engineers with the work of drawing up the plans. He is now having built in France a large automobile which approaches somewhat the idea of a palace car, as it will be divided into compartments. According to reports it is to have a sleeping chamber, a toilet room and a servants' compartment. This vehicle is to cost no less than $50,000; the motor is built for 30 horse power, and its reservoir will contain 25 gallons of gasoline. The consumption of gasoline will cost about $2 per hour. In this way King Leopold is to make his voyages in the future when he does not use his machine of the ordinary type.

A somewhat novel system for carrying the mail is now in use between two towns in France—Bonnétable and Connerré-Breillé. These towns, 10 miles distant, are on a line of narrow-gage railroad, but a part of the mail was formerly carried by a four-wheeled car running on the rails, provided with two bicycle movements and worked by two men. As this system of locomotion proved too slow, the railroad company has substituted a four-wheeled automobile car which has a 3-horse power gasoline motor, water cooled; the movement of the motor is transmitted to the rear axle by two round belts passing over two speed changing pulleys which are loose on the shaft and may be coupled by friction to a fixed pulley, mounted on the intermediate shaft. This shaft is connected by reduction gearing to a second intermediate shaft which carries a chain passing to the rear axle. Ball bearings are used throughout. A pedal operates a powerful band-brake upon the rear axle. The total weight of this car is 1,050 pounds, and it makes an average speed of 20 miles an hour. Since it has been put into use for carrying the mail its performance has been quite satisfactory.

An automobile exposition will be held at Hamburg, lasting from the 31st of March to the 14th of April. It will be installed in the Exposition Palace of the Rotherbaum Velodrome, a vast building, well lighted and having an area of 45,000 square feet. The Organization Committee are preparing for an exposition of considerable importance. Nine classes have been distinguished: 1. Automobiles and motors. 2. Automobiles in construction. 3. Moto cycles and voiturettes. 4. Boats. 5. Motors and accumulators. 6. Accessories. 7. Apparatus for automobiles and cycles. 8. Models, drawings, maps, etc. 9. Divers. At Breslau is held each year a kind of international fair or exposition of machines, which includes machines of all kinds, steam engines, etc., as well as automobiles and bicycles. This exposition, which is known throughout all Germany, attracts a large crowd of visitors to Breslau every year. the number being estimated at 25,000. The exposition lasts three days, and in general more than 150 exhibitors are represented, most of these being German firms, but some American, English, Swiss and Austrian firms are represented. This exposition is in its thirty-eighth year of existence. This year it will be held from the 6th to the 8th of June. It is expected that this year's exposition will contain a large number of automobiles shown by the principal German and European firms.

Telephone Journal at Budapest.

The system of "telephone journal" which has been in operation in Budapest for several years is meeting with increased success. The system was inaugurated in 1893; the subscribers receive their news by telephone instead of by a printed journal. All the interesting news is telephoned from the central office to the subscribers from 8 A. M. to 11 P. M. Each class of news comes at a certain hour, except for the news of the Stock Exchange and Parliament, which are given every half-hour as they are obtained. The subscription price is 75 cents per month by periods of four months each; no extra charge is made for the receiving apparatus or lines. The receiver is double, so that two persons may hear the news at the same time; the announcement of the communications is made by an electric bell. At the end of 1898 the system, which was limited to the city of Budapest, had already 550 miles of lines. At present the number of subscribers reaches nearly 7,000, this being eight times the number during the first year. The system is likely to be extended to the neighboring towns of Szegedin and Arad, as the preliminary trials which have lately been made have given good results.

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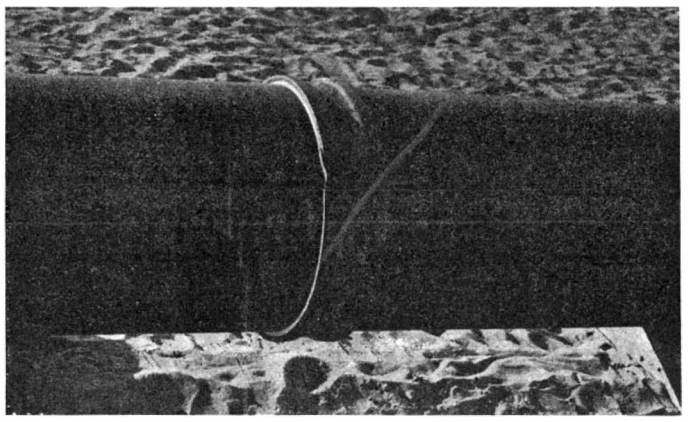
A NEW METHOD OF MANUFACTURING STEEL PIPE.

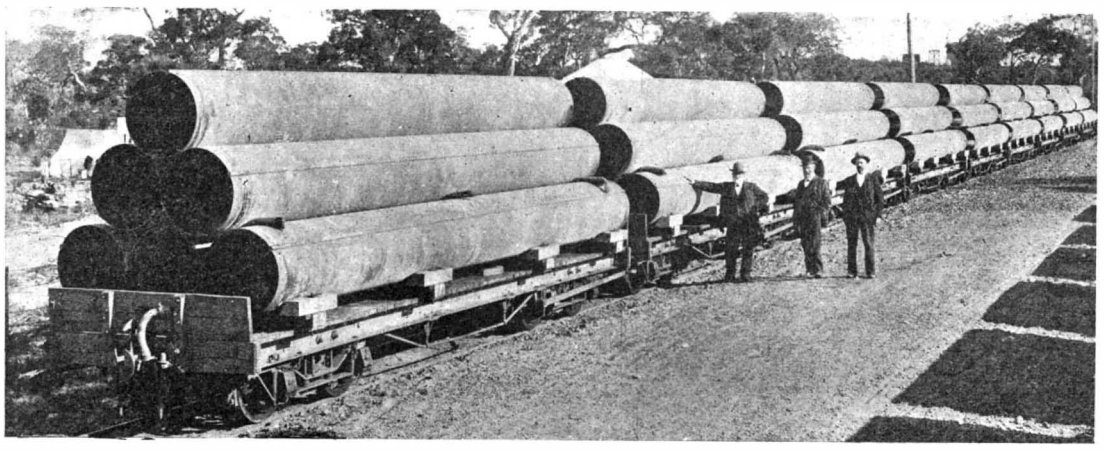
One of the most important and in some respects one of the most novel water schemes ever proposed and contracted for is that for carrying water from Perth, the capital of Western Australia, to Coolgardie, the central point of an extensive and comparatively modern group of gold fields. Unfortunately the development of this district is retarded by the lack of water, which is as scarce as gold is plentiful, the monthly output of gold for the colonies of Western Australia being nearly 200,000 ounces. Realizing that an abundant supply of good water was essential, not merely for the modern processes of gold recovery, but also for the health and comfort of the rapidly increasing population, the government sanctioned a very costly and elaborate scheme for piping water from Perth, the capital, to Coolgardie, a distance of 330 miles. The water is to be collected in a large storage reservoir at Mundaring, 24 miles from Perth, from which it will be forced through a 30-inch steel pipe by means of eight separate pumping stations, distributed along the route of the line. The total lift will be 1,200 feet. Three hundred miles of the pipe is laid in trenches and 30 miles will be carried on trestles.

The steel pipe will be laid in 30-foot lengths. The weight of each section with joint is about one ton, and the total weight of the whole line will be about 68,452 tons. This, by the way, is, with one exception, the largest contract for steel ever undertaken, the largest contract being that for the steel necessary for the construction of the New York Rapid Transit Tunnel, which exceeds the Coolgardie pipe line, we believe, by about 10,000 tons.

Apart from the magnitude of the undertaking, this pipe line possesses special interest because of the novel means adopted in the manufacture of the pipe itself, which is of what is known as the Ferguson locking-bar type, being so named after its inventor, Mr. Mephan Ferguson, of Melbourne, Australia, to whom we are indebted for our illustrations and particulars.

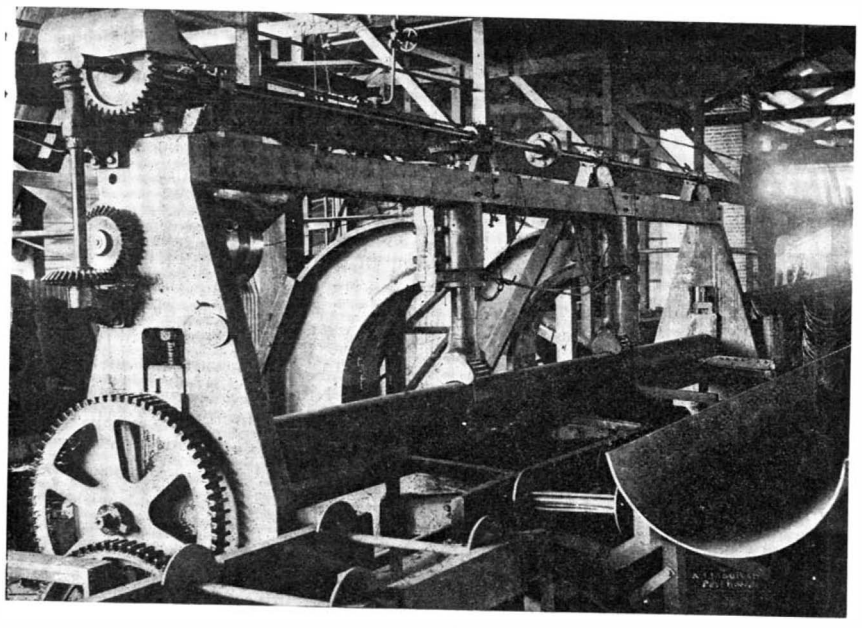


2. Wrought-Steel, Lead-Calked Joint.

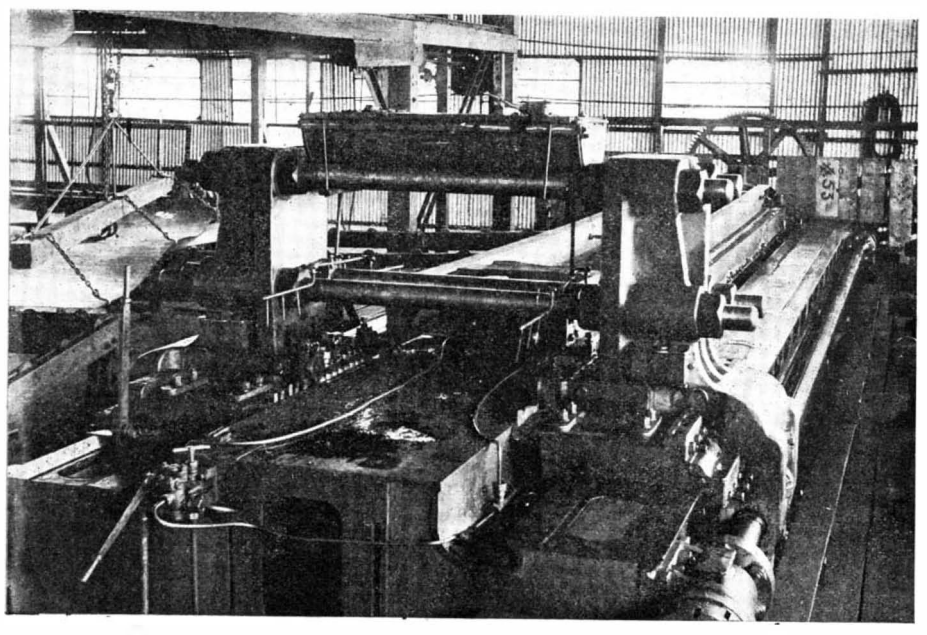


1. Fifteen Hundred Feet of 30-Inch Pipe Loaded on Cars.

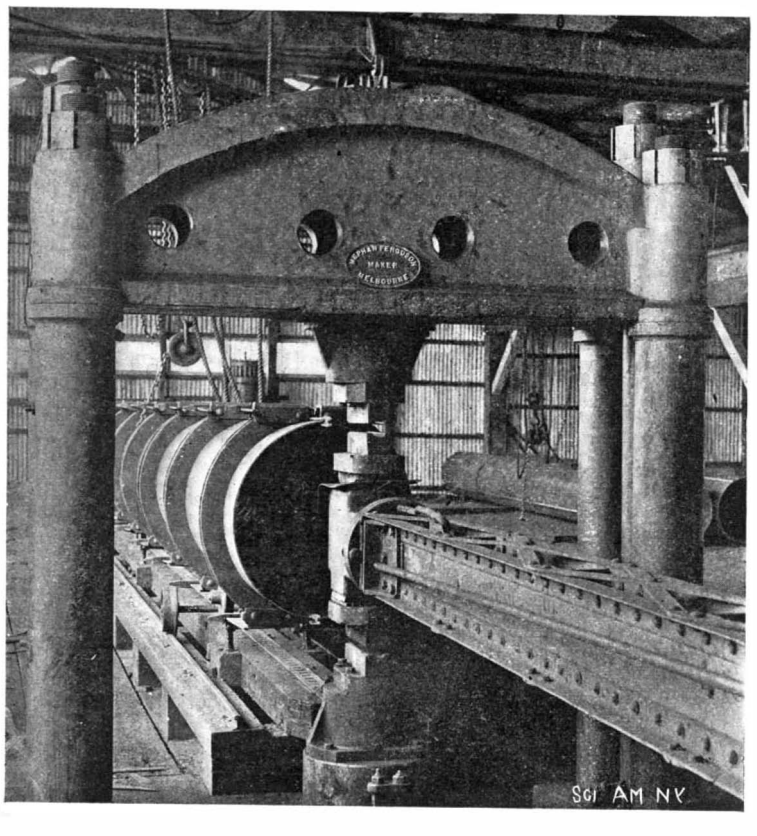
The method of manufacturing the pipe is shown in the accompanying illustrations. Each length is formed of two steel plates, each of which is bent to a half circle and its longitudinal edges upset in a special machine. Two halves are assembled together and their upset edges inserted in a pair of longitudinal locking-bars. Hydraulic pressure is then brought to bear on the locking-bars, which are thereby closed down over the upset edges of the plates, thus forming at each bar a double dovetail joint. Such, briefly stated, is the operation of manufacture. In detail it is as follows: After the plates have been put through a set of straightening rolls, they are clamped to a table upon which they are carried through two pairs of circular shears which cut them to exact length. They are then taken to the planing and upsetting machine, shown in Fig. 4, upon the bed of which they are securely clamped. On either side of the bed of the machine, which, by the way, weighs 100 tons, are mounted two massive saddles, which are connected together across the machine by heavy bolts. In these saddles are carried eight planing tools, four on a side, with each tool set slightly in advance of the one that follows it. Behind the tools are sixteen rollers, eight on each side, each of which, like the planing tools, is set some-



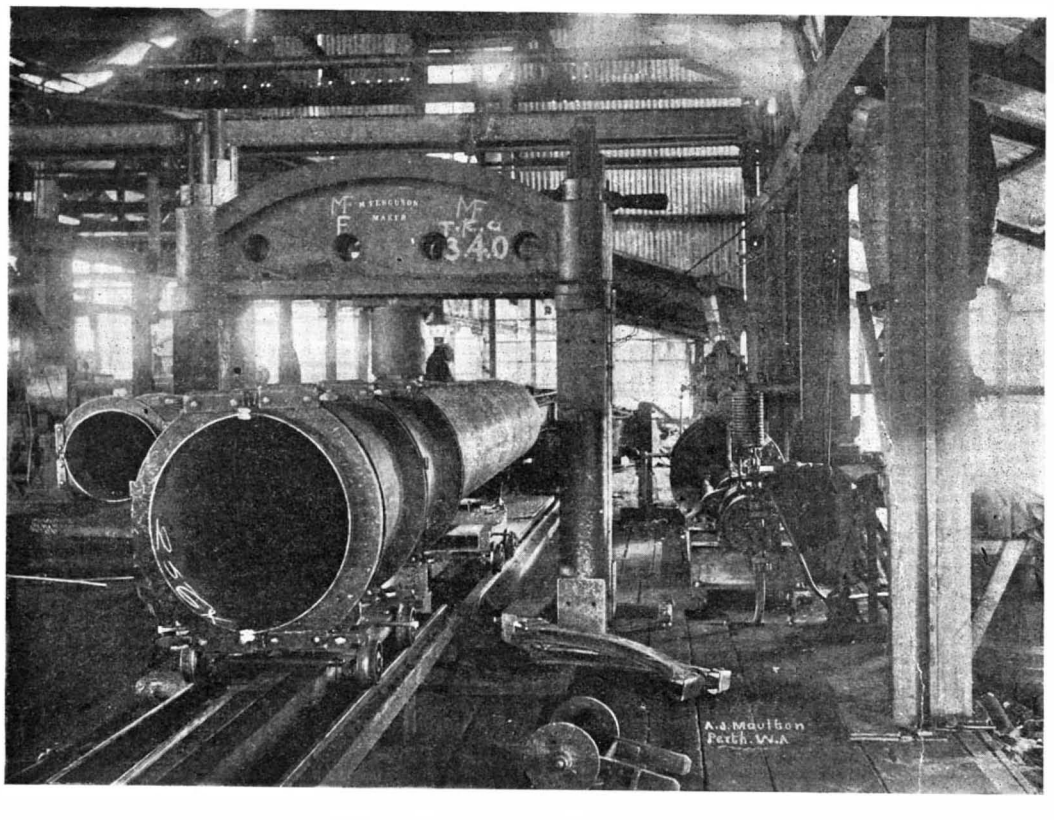
3. Bending Rolls.



4. Plate Planing and Upsetting Machine.



5. Pipe-Closing Machine, With Half-Finished Pipe.



6. Shows Pipe About to Enter Closing Machine.

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what in advance of the one that follows. The two saddles are caused to travel along the machine by means of two massive screws, one on each side. As the side saddles move along the plate, it is planed down to exact width by the tools, and then the edges, as thus planed, are upset by the rollers which follow, into the proper form for clamping into the locking-bar. The plate is then removed, a new plate inserted and similar work is performed upon it on the return stroke of the machine.

The plate is next taken to a crimping machine, not shown in our illustrations, where the necessary curve is given to the edges of the plate, so as to prepare it for the plate bending rolls which are shown in Fig. 3. These rolls, which are 30 feet in length, are provided above and below with a pair of suitable supports to prevent the rolls from springing away from the plate. The two upper supports are shown clearly in the figure referred to. The plates, after being rolled to the proper curve, are assembled with their edges resting in recesses of the two locking-bars, already mentioned. The locking-bar is roughly of a blunt I-section, as clearly shown in illustrations 5 and 6. The pipe, firmly clamped to hold the two halves and the locking bars in position, is then placed within the closing machine, Figs. 5 and 6, which consists of a massive frame carrying the upper and under closing tools, and the long mandrel in the front part of Fig. 6 which carries the inside tools. The pipe is placed upon the traveling table and run forward until the locking-bars are between the outside and inside tools referred to. Then, by means of a hydraulic piston acting upon the inclined plane on the mandrel, the squeezing tools are all brought home snugly against the two locking-bars. Hydraulic pressure is now exerted, and the locking-bars are squeezed snugly down upon the upset ends of the pipe. The amount of pipe upset at one stroke is, of course, only equal to the width of the squeezing tools, which work at the rate of about twenty strokes per minute, the pipe traveling through the closing machine upon a set of carrying trolleys, which are shown clearly in Figs. 5 and 6. The pipe is then taken to the testing machine and subjected to a pressure of 400 pounds per square inch, which is equal to a tensile strain of about 10 tons per square inch of the steel plate. After being coated with asphaltum, the pipe is ready for shipment.

We are informed that the locking-bar, *C*, of this form of pipe has shown itself, under official tests, to be stronger than two plates themselves, and as the 28-foot pipes, 30 inches in diameter, are turned out at the rate of about six per minute, it can be understood that this method of manufacture is highly economical, as compared with pipe with riveted seams. There is also the added advantage that the frictional resistance to the water is considerably less than that due to the rivet heads of a riveted pipe.

In illustration No. 2 is shown the form of joint which is used on this pipe line. It consists of a wrought steel ring, or thimble, whose inside diameter is increased from the edges inwardly, with the object that when the lead is run in at both ends, it will form a wedge joint that will act against the escape of the water.

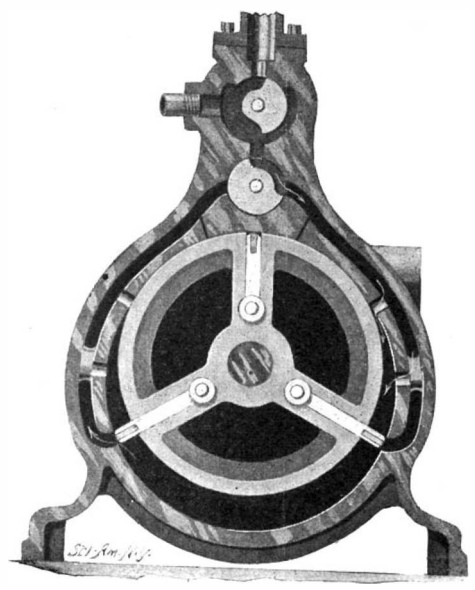
PORTER ROTARY ENGINE.

At the electric-light plant of Crawfordsville, Ind., a rotary engine invented by James A. Porter, of the same city, was recently tested with exceptionally gratifying results. The engine occupies a space 54 by 48 by 24 inches and weighs one ton. The tests proved that the engine is of 8 horse power, running one hundred revolutions per minute with an effective pressure of 12½ pounds and an expansion from 20 to 5 pounds. The high speed and steam pressure obtained make the engine very efficient.

As our illustrations show, the shaft is eccentrically mounted and the cylinder-heads are peculiarly grooved. In the center of the head is a cam-way which forms a bearing surface for rollers carried on the inner ends of the pistons. The outer groove or way in the head is engaged by the outer ends of the pistons. It is evident from our illustrations that the cam in the center serves to press the pistons into steam-tight contact with the cylinder-wall and to hold them to their proper places. Wear is taken up by spring packing.

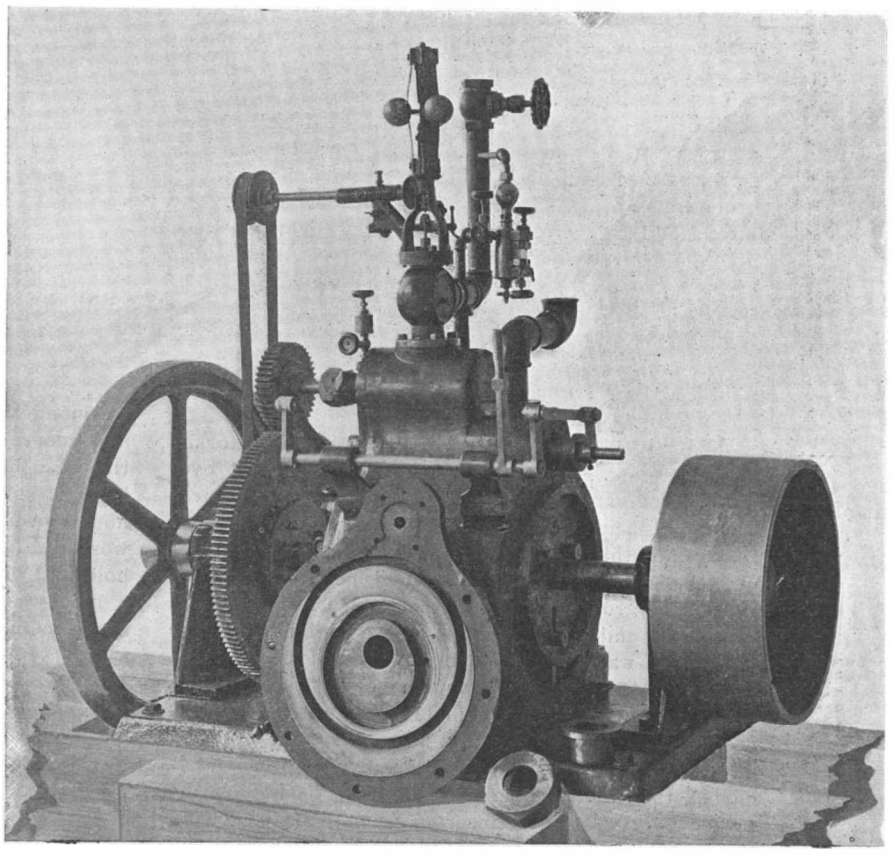
Partially surrounding the cylinder are two steam passages provided with openings leading into the cylinder, and with smaller openings to permit the surplus steam to exhaust, thereby avoiding back pressure. The arrangement of openings leading to the cylinder from the passages is such that the steam is not exhausted through one of the openings until the adjacent piston has passed the opening on the opposite side. Through these passages steam is supplied from two steam-chambers above the cylinder. In the chambers, valves are located which direct the flow of the steam. These valves are so connected by a link and levers that when one valve permits the entrance of the steam to one passage, the other valve acts as an exhaust for the steam discharged from the other passage. By means of this arrangement the motion of the shaft can be readily reversed by a single manipulation of a hand-lever.

One of the steam-chambers communicates with a



SECTION OF THE PORTER ENGINE.

steam-chest; the other serves as an exhaust. Within this steam-chest is a cut-off valve operated by gearing from the driving shaft of the engine, so that the steam can be cut off at any desired point of the piston-travel and used expansively. In order to start the engine when the cut-off valve is closed, steam is allowed to flow through a valved by-pass extending from the steam-supply pipe below the cut-off valve. As soon as the engine is in motion the by-pass is closed.



THE PORTER ROTARY ENGINE, SHOWING DETACHED CYLINDER-HEAD.

Million-Mile Railroad Records.

BY G. E. WALSH.

The relative longevity of the modern high-speed locomotive is interesting in view of some of the reports concerning the working-life of some of the older forms of engines. There have been several English locomotives which have made million-mile records, and they are still in use on some of the small branches. These English locomotives, however, were run on much finer roadbeds than those built in this country years ago, and the wear and tear on them must have been correspondingly less. It has been demonstrated many times in the history of railroading that the condition of the track more than the high speed determined the life of the locomotive.

In the past most of the American locomotives would average runs of 200,000 miles before going into the repair shops. To cover this distance it would require from three to five years. There are plenty of engines on the best roads which average 200 miles a day, or something like 1,200 miles a week. From 60,000 to 70,000 miles per year for a locomotive engaged in drawing heavy mail and passenger cars makes a record that is considered excellent. This record has been exceeded, and will be more than increased by one-third in the future by the more powerful engines, but the average of the fast engines to-day is really lower than this. Most train experts put the annual run for a good express engine at 50,000 miles a year. At this rate it would take twenty years for the engine to make the million-mile record if she was not condemned to the scrap-pile before that.

On many of the Western roads there are locomotives in service to-day that started business twenty and thirty years ago, and while no record has ever been kept of the number of miles they covered in that period it can be inferred from figures given that they have crossed the million-mile mark. Until within a few years there was running on the Chicago, Milwaukee & St. Paul Railroad an old Lawrence inside connection engine built in 1857. This engine was employed in all sorts of work, and during its period of usefulness extending upward of forty years it must have covered fully a million miles.

The active life of some of the modern heavy locomotives is something to be determined by the future. Like the swift ocean steamers they must deteriorate more rapidly when driven at their maximum speed, but after serving as fast mail expresses they will have a long period of usefulness on runs not quite so exacting. The modern big locomotives on the long-distance runs average more miles a day and week than the old-timers, and they will consequently cover the million-mile record in much less time. It is estimated that some of the crack locomotives engaged in carrying the fast transcontinental mails will reach this high record within ten or twelve years.

A few years ago the London & Northwestern Railroad published some statistics concerning one of their locomotives. According to these figures, published by F. W. Webb, locomotive engineer, she made the million-mile record in nine years. Every day except Sunday this locomotive made the run between London and Manchester and back, covering in the round trip 367 miles a day. The engine was 50 feet long, and weighed 33 tons, with a tender weighing 25 tons and carrying 1,800 gallons of water. Either trip of 183½ miles was made regularly on schedule time of 4¼ hours, and not once in the nine years did the engine lose a day except on Sundays. These days were used for fixing her up and making such necessary repairs as were demanded. Her record is without parallel in English or American railroading.

Cinematograph for the Blind in France.

Dr. Dussaud, of the Psychological Institute of Paris, gave a lecture on February 16, at the Hospital des Sociétés Savantes, on the education of the blind and deaf. A large audience witnessed interesting experiments founded on his method for supplementing the senses of these two classes of unfortunates.

The cinematograph for the blind is a machine which passes under the fingers of the blind a series of reliefs representing the same object in different positions—the branch of a tree, a bird, or any other object. The blind person has the illusion of moving scenes just as photographs passing over a luminous screen lend the illusion to those with sight.

Dr. Dussaud has also arranged an electric vibration for the use of the deaf who are incurable. This gives them the notion of musical rhythm. For those not entirely deaf, he has invented a "gradual amplifier of sounds," which supplements the organs of hearing and in some instances improves them.

Dr. Dussaud expressed the hope that these two inventions would materially aid in the education of the deaf and blind. The doctor gave a number of statistics already furnished by him to the Academy of Medicine and the Society of Biology, showing that his method had been applied during the last four years to more than three hundred patients affected either with blindness or deafness, and that in most cases the results obtained had been extremely satisfactory.

Through the death of Prof. J. D. Whitney, its former owner, the famous Calaveras skull has come into the possession of the Peabody Museum of American Archæology and Ethnology. Prof. Putnam visited the Calaveras region last summer to examine the various gravels in the Mattison mine, where the skull was discovered.

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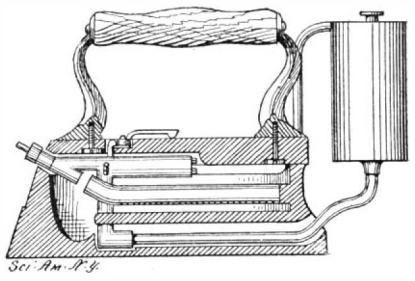
A NOVEL SELF-HEATING SAD-IRON.

One of the drawbacks to the more general introduction of the self-heating sad-iron is the necessity of using as fuel a high-grade gasoline, which, in country villages, cannot always be readily obtained. The drawback has been simply enough avoided in a new sad-iron invented by Mr. Iver Wickland, of West Superior, Wis. Besides overcoming the difficulty mentioned, the inventor has also devised a burner which completely consumes the vapor formed, and has provided a generator which maintains a constant pressure.

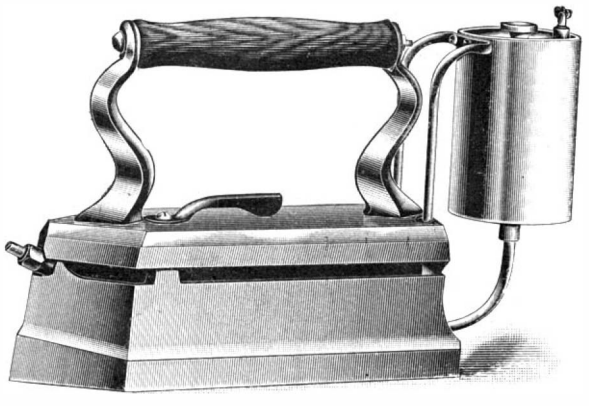
The illustrations presented herewith are perspective and partial sectional views of a tailor's goose made according to the principles of Mr. Wickland's invention.

The oil-reservoir is supported at one end of the iron. From the lower end of the reservoir a tube extends through the lower portion of the iron beneath a metal shield. The tube is connected with a retort in which the oil is received for the generation of gas. The retort communicates with a valve-casing provided with a needle-valve and arranged to discharge the vapor in a burner-tube located directly above the shield. Openings in the lower portion of the burner-tube discharge the gas downward on each side of the shield. The forward portion of the iron constitutes a cup for oil. When ignited this oil will heat the retort and adjacent parts sufficiently to generate vapor. By opening the needle-valve the vapor is mixed with air, forced into the burner-tube and ignited.

The iron can be kept hot for more than sixty hours at a cost of twenty cents. The heat can be regulated as desired. Only one iron is required for the house laundry. No stove is needed to heat several irons. The combustion of the gas is so complete that no odor is perceptible.



PARTIAL SECTION OF A SELF-HEATING TAILOR'S GOOSE.



PERSPECTIVE VIEW OF SELF-HEATING TAILOR'S GOOSE.

A SINGULAR INDUSTRY IN THE POISONOUS INSECTS OF CALIFORNIA.

BY CHARLES F. HOLDER.

Southern California has a number of so-called poisonous insects—scorpions, centipedes, tarantulas and others; yet it is rarely that they are seen outside the curiosity shop. In a residence of fifteen years in this section the writer has never seen any of these insects where they should not be, namely, in the house, and has only found them after a diligent search—a strange

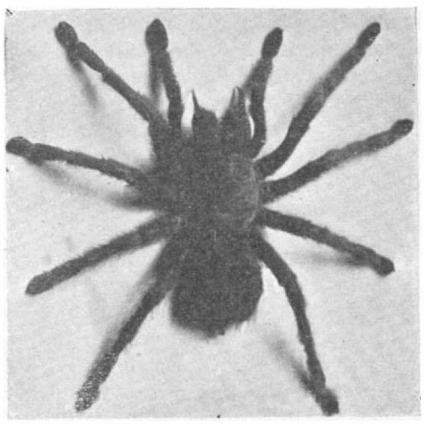


Fig. 1.—TARANTULA.

contrast to life on the Florida reef, where at night a crunching sound underfoot, or beneath the rocker, would tell the story of a wandering scorpion, the sting of which is extremely painful.

In Southern California there is, singularly, a great demand for all the insects mentioned, which constitutes a business of some magnitude, involving the

Fig. 3.—SCORPION.

more or less skilled labor of a number of persons. In China such a demand might be understood, as objects of this kind are of use in the medicinal dietary of the Celestial Kingdom; but what Americans not naturalists should want with hideous tarantulas, unspeakable centipedes and others would seem a mystery, yet these commodities are eagerly sought for by tourists in such numbers that thousands are sold annually, and one dealer stated that he had difficulty in supplying the demand. When asked to explain the apparent craze for such objects, he replied: "They fall in line with what are known as curiosities, and

Southern California being the great American tourist center, they naturally find a sale. The average tourist thinks it necessary to carry home something as a souvenir; in nine cases out of ten the same thing can be bought in the East; but they wish something that came from the locality in which they are visiting. I sometimes think that tourists wish to convey the idea to their less fortunate friends that they have been traveling in a dangerous country, and so send or take back home the poisonous insects as evidence of it. In any event, there is an ever-increasing demand for them."

There are in Southern California several wholesale houses who employ men to mount these horrors, and the method of work is not uninteresting. While one rarely sees a scorpion or tarantula in this section, a careful search for them is generally repaid, but it is not near houses. In Florida the scorpions are surface lovers, and houses, and especially old board piles, offer the greatest inducements to them; but in California this insect is a burrower and found underground, as are the tarantula and trapdoor spider. The tarantula trade is, perhaps, the most important; the huge hairy creatures being more repulsive than others are consequently more in demand. The low hills to the south of Pasadena were once famous collecting grounds, being partly adobe, the soil especially suited to the building operations of the insect burrowers. At this place I once found the collectors of one of these firms. They were boys, and each was supplied with a large bottle of water, a tin can and a forked twig or stick. The ground was rough, dotted over with gopher and squirrel holes, and every few yards a hole about an inch and a quarter across could be seen. Sometimes this was covered with a gossamer shutter of web, but generally it was wide open. Placing his can on the ground, one of the boys uncorked the bottle he carried and poured a little of the contents into the hole. The water was probably tinctured with alcohol, as I doubt if pure water would have sent the occupant up so quickly; a fierce spider with a span of legs nearly four inches in extent, a huge hairy creature with a body seemingly as large as that of a mouse. Out it darted, then seeing danger ahead, drew back; but the forked twig was deftly inserted beneath its body, and the spider was tossed several inches away where it settled back in the manner popularly described as "on its haunches," showing the death-dealing fangs ready for action.

It was a tarantula, the Mygale hentzii of science, a near ally of the bird-eating spider of South America, and a creature to admire from a distance. But the young collector treated the insect with scant courtesy, placing the mouth of the can before it and hustling the giant into it with a businesslike air; then with bottle in hand he moved on. The next find was a trap-door spider (Fig. 2), very common in Southern California. This is the Cteniza Californica of science, a most remarkable and ingenious nest builder. The spider sinks a tube from six inches to a foot in length, lines it with silk so that it presents a perfect satin finish; then a door of silk and clay is made, which fits so perfectly that it is water and air tight, this works on a hinge, also made of silk. Just on the inner rim are several small holes, which look as though they might have been made with a pin; these are where the spider grips the lid with its mandibles to hold it down. This the boy illustrated for my benefit. The nest could only have been seen by an expert, as the outer part of the lid was exactly like its immediate surroundings in color and tint; but the collector's eye was keen, and he seemed to find the nests with perfect ease. As one was discovered he dropped to the ground and deftly inserted the point of his knife beneath the lid, lifting it up and exposing the silvery interior; a most marvelous structure, as the work of a spider. Dropping the lid the boy asked me to lift it, saying that the spider was upon the other side holding it down. As I inserted the knife and lifted I could feel the little owner tugging at the lid, and as I raised it, caught a glimpse of the hairy legs. She had the lid firmly in her mandibles and was holding it with a force which would be effective against what might be termed her normal enemy. The spider was ousted by pouring water into the tube, and quickly landed in the tin cup. The boy now cut out the door of the tube and about four inches of the latter which was later mounted in a square box and the spider placed within to tell the complete story. In the course of the forenoon a number of tarantulas were caught in this way, also as many trap-door spiders. Scorpions were found in small burrows near the surface, or often in the holes of lizards.

The tarantula merely digs a burrow from six to twelve inches in depth, and makes no pretense of covering it, though sometimes there is a mass of web at the bottom, and at times a web placed over the entrance. The insect is a night-feeder, roaming about, preying upon crickets, beetles and other insects so unwise as to venture forth at the same time. The spiders brought in by the boy collectors, who search the country for them in all directions, are killed by immersion in alcohol, and handed over to the taxidermist who prepares them as quickly and cheaply as possible; the abdomen is filled with cotton and the insect then dried in a position to show its greatest spread. The room of the taxidermist is a chamber of horrors; the walls covered with tarantulas; scores of them drying,

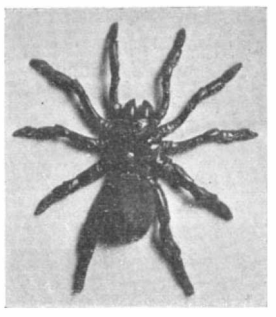


Fig. 2.—TRAPDOOR SPIDER.

while hundreds more await preparation. Exactly how many of these insects are sold in this way to the tourist trade is not known, but the firm referred to—Messrs. Wakely & Company—mount thousands every year, not to speak of centipedes, trap-door spiders and horned toads.

Among these insects is a giant wasp, common here and generally sold under the title of tarantula hawk, the wasp being an inveterate enemy of the spider. I have often followed the wasp in its search, and no hound ever tracked a fox with more eagerness. It would walk rapidly over the ground, examine every hole and crevice, vibrating with emotion; and when a hole was discovered, darted down into it eagerly; a few moments later perhaps out would come spider

Fig. 4.—TARANTULA HAWK.

and wasp engaged in a terrific battle. The wasp was overmatched, as regarded size, its burly antagonist rolling it over and over; but the wasp evaded the strong mandibles and finally managed to drive its rapierlike sting into the tarantula, which paralyzed it; indeed, the effect was at once apparent, the spider

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retreating, followed by its active enemy which merely desired to use it as depository for its eggs.

In almost every town in California the singular industry described is carried on, and its effect in Pasadena has been to materially diminish the supply of tarantulas, the places where they were once common knowing them no more.

The Recent Eruptive Period of Vesuvius—Simultaneous Formation of Two Nitrated Salts in the Crater.*

The eruptive period of Vesuvius commenced on the 3d of July, 1895. It continued with uniform phenomena until September 3, 1899, when the lava ceased to flow by the lateral fissure. From that time the crater, which was then 656 feet deep, began to fill up again. On April 24, 1900, it was only 260 feet deep, and contained a magma of bases rich in aeriform products. A period of a month of extreme activity ensued. There was no emission of lava, but the explosions within the crater were intensely violent, especially from May 4 to May 14, the maximum occurring on the 9th of May. They could be distinctly heard throughout all Campania Felicia. The crater was enlarged by 13 or 16 feet in diameter. At the end it measured 537 feet from southwest to northeast and 590 feet from east to west. The circumference was 1,771 feet. The flames were abundant, due to the emission of the vapors of sulphur and hydrogen sulphide. The greatest height attained by the bombs and scoriæ was 1,761 feet from the bottom of the crater.

On the 9th of May a bowlder measuring about twelve cubic meters was thrown out, which weighed approximately thirty tons. This was the greatest ejected, and took about 17 seconds in passing over the whole trajectory, falling on the ground with a velocity of about 262 feet a second. The vis viva of the vapors which had propelled it was estimated at 607,995 horse power.

The quantity of solid matter thrown from the crater during the explosive period (April and May) was about half a million of cubic meters. These emissions increased the height of Vesuvius by 33 feet. The highest point previously was 4,221 feet above the level of the sea; now it is 4,273 feet.

I remained on the mountain for three consecutive days, the 11th, 12th and 13th of May. On the 13th, in the morning, there was a copious emission of vapors; toward noon the explosions were resumed, and soon reached a point of extreme intensity. From my position near the border of the crater I was observing the action closely, when I was startled by a formidable explosion, which rained about me a shower of myriads of stones and incandescent scoriæ. I escaped as by miracle. Among the most important phenomena was the complete envelopment of the crater with flames and the multitude of bombs bursting violently in their course through the air. It was a marvelous spectacle. Around me were lapilli, covered with sal ammoniac and scoriæ, with a lustrous patina of metallic appearance, formed of ferric nitrite.

As is known, M. O. Silvestri, stimulated by the experiments of Henri Sainte-Claire Deville, undertook observations on the lavas of Etna, for the purpose of investigating volcanic theories, especially relating to the influence of chemical dissociations, and that he reached very satisfactory conclusions with respect to the genesis of certain nitrated compounds formed within volcanoes.

Thus, by passing a current of chlorhydric acid over reheated iron-bearing silicates, Silvestri obtained water, free silica and ferric chlorides. On heating these chlorides in a current of ammonia there were disengaged besides hydrogen and ammonium chloride, chlorhydric acid and ferric nitrite. Finally, in causing the reaction together, on the reheated lava, of chlorhydric acid and ammonia (or ammonium chloride), pure hydrogen, chlorhydric acid and ferric nitrite were obtained with separation of sal ammoniac (ammonium chloride).

Without ignoring the great difference between the operations of nature and those of our laboratories, I have no hesitation, in view of my observation of a true isochronism in the production of ammonium chloride and of ferric nitrite in the crater of Vesuvius, in holding, according to the experimental results I have cited, that there exists an intimate genetic connection between these two nitrated compounds of volcanic origin.

* R. V. Matteucci in a paper presented at the Académié des Sciences.

The Current Supplement.

The current SUPPLEMENT, No. 1317, contains many articles of interest along many lines. The first page is occupied by an engraving showing the removal of Moreau-Vauthier's statue "La Parisienne" from the monumental gateway of the late Paris Exposition. "The Foothills of Colorado" is by H. A. Crafts. "The Canals of Mars" is by Miss M. A. Orr. "Information Concerning the Angora Goat" is accompanied by several illustrations. "Snow Upon Railways" describes the systems in vogue on the Trans-Siberian Railway. "American Engineering Progress" is continued.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

COIN-CONTROLLED TELEPHONE.—JULIO E. CORDOVEZ, Panama, Colombia. The characteristic features of this telephone apparatus are a support for the receiver, which support automatically changes its position as the receiver rests thereon or not; a movable coin-support; a circuit designed to be closed by the movement of the coin-support; and a movable coin-retainer operatively connected with the receiver-support and arranged to keep the coin upon the coin-support and to release the coin when the receiver is put back on its support. Thus the introduction of a coin of a certain value is necessary in order to close the speaking-circuit.

ELECTRICAL DEVICE FOR ALTERNATING CURRENTS.—ALBERT NODON, Paris, France. The inventor has discovered that an electrolyte formed of a solution of phosphoric acid to which ammonia may be added and in which are plunged two electrodes, the one of graphite or plumbago, and the other of an alloy of zinc and aluminium, has the property of arresting one of the phases of an alternating current but of permitting the other phase to pass freely. In order continuously to convert the two alternate phases it is necessary merely to arrange two similar couples in parallel, having their electrodes disposed in reverse order. By experiment, it has been found that two similar couples thus arranged can convert alternating currents having a mean electromotive force of 200 volts.

TELEPHONE-RECEIVER HOLDER.—GEORGE S. MEYER, Newburg, N. Y. It has been the object of the inventor to provide a simple device by means of which the receiver will be supported in listening position near the transmitter, so that the hands may be left free to take notes. The arrangement consists of a bar in engagement with and projecting from the transmitter-arm in such a position that the receiver is in proper position for use.

Mechanical Devices.

BALING-PRESS.—ALBERT L. TREESE, Jennings, Oklahoma Territory. With this improvement, the bale formed in an ordinary cotton-press receives a final compression. Mr. Treese prefers to employ his invention as an attachment to a cotton-press. The complete apparatus comprises rotatable baling-chambers which are alternately filled with cotton. A plunger operates in conjunction with one of the chambers at a time to compress the cotton against a platen. A removable follower is designed to be carried by the plunger; and in conjunction with the removable follower a frame is employed, carrying a number of platens to compress the cotton. At one side of the platen a hydraulic device is arranged which can be connected with the removable follower to compress the material finally.

DUMPING-WAGON.—THOMAS WRIGHT, Jersey City, N. J. This invention relates to a class of dumping-wagons which discharge the load by tilting the wagon-body rearwardly. The object of the invention is to provide a dumping-wagon of novel construction which is better adapted for the discharge of the load and the replacement of the tilted body than wagons of its class as heretofore constructed, and which will also permit the ready removal of the wagon-body for the reception of a load and for its subsequent replacement on the running-gear of the wagon.

APPARATUS FOR PRODUCING MOLDS FOR CAST-IRON PIPES.—ERNST FORSTER, 43 Sagoroduiji-Prospect, St. Petersburg, Russia. This invention is designed to produce at one operation any number of molds for tubes, pipes, and other articles of regular form and considerable length. The castings made from such molds are perfectly seamless; the molds are not divided either longitudinally or transversely. The time required for making a mold for sixteen pipes does not exceed twenty minutes, it is claimed. The efficiency of the apparatus is, therefore, evident. Further merits are the great exactness and accuracy, and the omission of mold boxes inclosing the molds, thus allowing the molds to dry properly.

MERRY-GO-ROUND.—WILLIAM F. MANGELS, Coney Island, Brooklyn, New York city. The merry-go-round is of that type having a crank-shaft for imparting movement to the seats. The object of the inventor is to provide improvements in the construction of such merry-go-rounds whereby the driving-gear for the crank-shaft is completely relieved of the weight of the revoluble frame. Consequently, undue strain is avoided and the frame is supported independently of the gearing to insure an easy running of the machine with comparatively little power.

TWINE-HOLDER AND CUTTER.—RAYMOND D. WEAKLEY, St. Louis, Mo. The device holds the twine in a suitable carrier. Cutting-blades are brought into action at any time after the twine-carrier has been brought to a position within a casing. The movement of the twine-carrier within the casing is accomplished by the operation of a movable knife. When the twine has been cut, the movable knife is relieved from pressure, and the twine-carrier is automatically carried to its normal position.

MACHINE FOR SETTING CALKS IN BOOTS AND SHOES.—CHARLES R. JOHNSTON, Eureka, Cal. The invention provides a simply-constructed durable machine for calking boots and shoes. The improvements made by the inventor have perfected the construction and increased the efficiency of operation.

CASH-DRAWER.—JULIUS OHMEN, Manhattan, New York city. The cash-drawer comprises a money-receptacle having two locking devices, both controlled by the drawer-knob. One locking device serves to lock the money-receptacle to the drawer, and the other locking device serves to lock the receptacle to a stationary part. An alarm is actuated by the drawer. Mechanism is controlled by the last-mentioned locking device to throw the alarm in or out of action according to the position of the locking devices. The alarm is given when any person not familiar with the construction of the drawer seeks to steal the money.

LATHE-DOG.—PHILIP SCHWICKART, Brooklyn, New York city. The lathe-dog comprises a body having V-shaped members. On one of the members is an extension formed with a number of recesses located one above the other. A clamping-bar has its fulcrum in one of the recesses. On the free end of the clamping-bar an adjustable bolt is pivoted, engaging a flange on the other body member. Pivoted on the clamping-bar between the fulcrum and bolt is a clamping-block, having concave sides located at different distances from the pivot of the block. Eight different adjustments can be made, thus adapting the lathe-dog for objects of different diameters.

CURRENT-WHEEL.—EVER PETERSON, Spokane, Wash. The water-wheel comprises a supporting-shaft to which a shell is attached. Spokes pass through the wall of the shell and are secured at their ends to the ends of the shell. Blades are attached to the spokes. Forward of the shell is a tapered casing. As the current strikes the taper it is divided and thrown out to strike the several blades simultaneously; thus the eddies of the stream will be overcome and greater power obtained.

Vehicles and Their Accessories.

BICYCLE-SUPPORT.—EBEN MILLER, Fredericton, New Brunswick, Canada. The bicycle-support comprises essentially a supporting frame on which a rack-bar is movable. Gear-wheels engage the rack-bar. On the gear-wheels supporting-legs are carried, by the movement of which a wheel-engaging device is operated. The supporting-device is simple in its construction and can be very easily adjusted.

WHEEL.—OTTO TEIGEN, Lowry, Minn. The purpose of this invention is to provide a vehicle-wheel which will yieldingly support its load. To this end the invention embodies a wheel with its rim and hub connected by longitudinally-extensible and contractible spokes hinged in place and provided with springs which have their ends respectively connected with the hub and rim.

SPEED-GEAR.—SEDGWICK M. WADE, Andover, Ohio. This invention is a means for transmitting motion and for varying the speed and direction of motor-vehicles. The gearing comprises two worms driven in the same direction. Between the worms is a double-bevel worm-wheel movable to engage either worm. A spur worm-wheel is movable to engage one of the worm-wheels, and a crown worm-wheel is movable to engage one of the worms.

Railway Appliances.

TIE.—HIRAM STOUT, Kingman, Kans. The railway-tie comprises a pair of hollow stringer-blocks made of clay, to which blocks a tie-bar is bolted. Wooden chairs receive the rails and are interposed between the blocks and rails and have recesses at their under sides to receive the ends of the tie-bar. The chairs form cushions for taking up the vibration and also prevent wear on the clay blocks.

CONVERTIBLE FREIGHT-CAR.—OSCAR B. CRITCHLOW, Leadville, Colo. The car is so constructed that it can be conveniently converted from an ordinary flat-bottom box-car for carrying freight to a hopper-bottom box-car for carrying grain. The floor for the car-body is made in sections arranged to extend either in a horizontal position on the floor-supporting timbers, or to hang with their outer ends on the supports and extend from the car-body inward and downward to the floor-members at or near the middle of the car. A conveyer-casing has a conveyer-screw at the middle of the car into which the floor-sections discharge. Slides for closing the casing are controlled from the outside of the car.

LOADING DEVICE FOR RAILWAY-CARS.—WILLIAM P. PORTER, East Jordan, Mich. By means of this apparatus railway-cars can be loaded without being side-tracked. The machine employed comprises a platform on which a motor is carried. A transverse shaft is geared with the motor. With the transverse shaft longitudinal shafts at the sides of the platform are respectively geared. Keepers are carried at the sides of the platform. In the keepers, uprights are slidably mounted, which uprights carry racks engaged by pinions on the longitudinal shafts.

Miscellaneous Inventions.

SUPPORT FOR BUCKETS.—JOHN LOWE, Arlington, Kans. The bucket is to be used in milking, and for that purpose is provided with supporting devices which can be attached to the knees of the milker, so as to leave both hands free. When the bucket is not in use the supporting devices can be carried close to the side of the bucket.

ARTIFICIAL TOOTH.—WILLIAM K. SLATER, East Tennessee National Bank Building, Knoxville, Tenn. The invention comprehends the formation of artificial teeth in which keepers are baked projecting above the gum ends of the teeth in the direction of the longitudinal axes of the teeth, and are arranged by means of loops or bent ends for secure attachment to a retaining wire. These keepers are located in those portions of the teeth where there is the greatest body of porcelain. The teeth depend almost entirely upon the wire for their attachment to the plate.

WATER-DISTILLING APPARATUS.—DICKINSON L. ROSE, Mankato, Minn. The apparatus is specially adapted for domestic use. The construction comprises a vertical boiler which is open at the top. A condenser is located above the boiler, and a water-reservoir exterior to the boiler. The water-reservoir has an upward extension composed of double walls, separated by a space for receiving the water of condensation, both walls surrounding the boiler, and the outer one being attached to the condenser and forming the outer side of the condensing space above the boiler. The apparatus removes volatile and mineral matter, and effects rapid condensation and aeration.

NUT-LOCK.—SAMUEL S. JAMISON, Saltsburg, Pa. When once applied, the bolt and nut will be locked together without the possibility of being loosened accidentally. To secure this end the inventor employs a nut having a tapered hole provided with a series of independent angular projections. The angular edges are sunk in the bolt end and allow the metal of the bolt to spread into the angular recesses between the angular projections.

PULP-STRAINER.—JAMES W. PACKER, Glens Falls, N. Y. The pulp-strainer for paper-making comprises a fixed support, a diaphragm to which a plunger is secured, and a cam for operating the plunger. An arm

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or bar projects from the support and is connected with the plunger. A spring exerts pressure on the arm or bar. The plunger properly actuates its part of the diaphragm to draw off the fibers through the openings in a screen into a suction-box, the material flowing by its gravity into a receiving-box and over a gate. The provision of a single outlet for two or more suction chambers having a number of screen-plates brings the pulp into a separate compartment in the receiving-box, so that the operator has full control of the pulp, regardless of the number of suction-chambers in the machine.

ADJUSTABLE GUN-STOCK. — Joseph N. Zoller, St. Matthews, Ky. This attachment for gun-stocks enables one gun to be used for various purposes. An adjusting head is pivoted in the stock and attached to the grip. The head is provided with peripheral teeth, between the spaces of which a bolt held to slide in the stock can be projected.

WASH-TUB ATTACHMENT. — Otto Schweitzer, Paterson, N. J. The inventor has provided a wash-tub with a movable partition enabling the wash-tub to be used as a bathtub. On the upper edge of the partition, levers are mounted. A plate is pivoted on one lever and has sliding connections with the other lever. A screw is carried on the partitions and works with the inner ends of the levers.

STOOL.—John M. Burdum, Batavia, Ill. This stool is to be used in boot and shoe stores and comprises a seat for the salesman and a rest for the foot of the person on whom a shoe is to be fitted.

CRUCIBLE.—Porter W. Shimer, Easton, Pa. The crucible is to be used for fusing or highly heating metal or other material in an atmosphere of any gas. The crucible is provided with a hollow stopper seated on a rubber gasket and having means for cooling the stopper and crucible and circulating air.

WEATHER-STRIP. — William L. Smith, Homer E. Ashcraft and William O. Jamison, Seymour, Iowa. This weather-strip can be attached to any door. When the door is closed a member of the weather-strip is firmly in engagement with a threshold-strip. As the door is opened, a protective member of the weather-strip is automatically carried up to engagement with the body of the weather-strip; as the door is closed the protective member of the weather-strip is automatically brought into engagement with the threshold-strip and lodged in protective position.

GAME.—John G. Floyd, Mastic, N. Y. The apparatus employed in this game comprises a course, defined at its ends by goals. In this course a ball is to be placed. Players arranged in opposing teams are to have for their object to protect their respective goals and to prevent their opponents' forcing a ball past the goal. The apparatus can be quickly set up in a room or on a lawn.

SPACE-BAR FOR LINOTYPE MACHINES. —David A. Hensley, Vicksburg, Miss. The improved space-bar consists essentially of two parts or wedges, the upper one of which may be termed a stationary member inasmuch as it is held against upward movement in the ordinary manner, while the lower part may be termed the movable member, as it is driven by the usual or any improved mechanism for the purpose of expanding the space-bar. The operation of the improved space-bar is the same as that of ordinary space-bars. Superior results are obtained, however, owing particularly to the fact that a shield is employed of substantially the same outline as the movable member, which shield is of uniform thickness instead of being wedge-shaped as in other constructions. It is impossible for either the movable wedge or the shield to spring away from the stationary wedge or to move transversely or edgewise.

CALENDAR. — Arthur A. Sparks, San Francisco, Cal. The calendar relates to that class in which a device is provided for indicating at a glance the day of the week and the month. Each one of the date-spaces has a holder or fastening device. An indicator can be secured to any of the fastening devices. To prevent accidental loss of the indicator, an elastic string or cord is employed.

STOVE.—Samuel W. Jackson, Selma, Cal. From the top plate of the stove a combustion-chamber, and an inner or suplementary combustion chamber, are hung. A stand-pipe extends up from the bottom wall of the outer combustion chamber into the inner combustion chamber. Fuel is economized; and the draft is controlled in a simple, novel manner.

Designs.

GARMENT-HOOK. — William H. Goss, Stonington, Me. The hook comprises two upwardly-curved members and an upwardly and downwardly curved member.

DISPLAY SAMPLE-TUBE. — Charles F. Price, Richmond Hill, Queens, N. Y. The leading feature of the design consists of a glass tube closed at one end, and decorated at the other end with a cap which extends for some distance along the body.

PLAITING-BLADE.—David Kisch, Manhattan, N. Y. The blade comprises a number of transversely disposed parallel tongues beveled on one face and convexed.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(8143) J. W. B. writes: 1. I desire to make a helix to magnetize a ⅞-inch bar of octagon steel. How long and how many turns of wire, and of what size wire shall I make it? I get current from a dynamo. A. The statement that the current is from a dynamo gives no clew to its voltage, which must be known before a coil can be constructed to magnetize a magnet. However, proceed as follows: Wind a coil of No. 12 cotton-covered wire of a size that the bar will slip easily through the coil. Any insulated wire will do as well, if magnet wire is not at hand. Make perhaps 100 turns, number not important. Connect this in series with a lamp. Turn on the current, and pass the bar back and forth through the coil. Continue this till by experiment the bar is not made any stronger by further treatment. If the lamp is an arc lamp, the work will soon be done; if it is an incandescent lamp, longer will be required. The flow of the amperes around the bar magnetizes it. The process is very simple. 2. Can I make good bar and U magnets, using steel ends and wrought-iron center? A. Yes; the iron neither helps nor hinders the magnetism.

NEW BOOKS, ETC.

The Scientific American Cyclopedia of Recipes, Notes and Queries. Edited by Albert A. Hopkins. Sixteenth Revised Edition. New York: Munn & Company. 1901. Large 8vo. Pp. 790. Cloth, $5; sheep, $6. Appendix sold separately for $1.

The first edition of this book appeared in 1891, and within the past decade it has gone through sixteen editions (including the present)—a fact which, alone, is sufficient to attest the great value of the work as a book of reference, solving the difficulties of all classes, from the chemist and technologist, the manufacturer and artisan, down to the housewife and the cook in the kitchen. It is by far the most compendious work of the sort ever attempted, comprising upward of 15,000 recipes and formulæ, and usually embracing minute directions for carrying out the processes. The titles are arranged alphabetically, thus facilitating consultation. The book is well and clearly printed on good paper and is strongly and substantially bound.—National Druggist.

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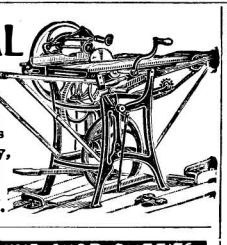

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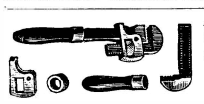

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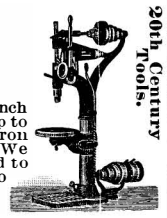

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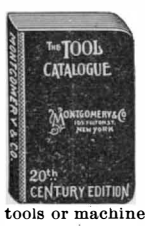

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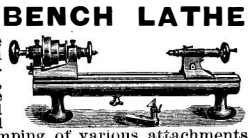

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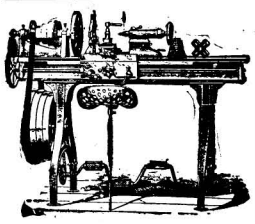

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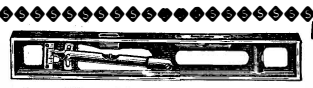

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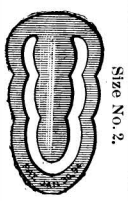

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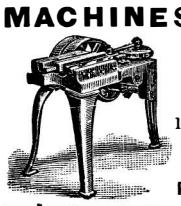

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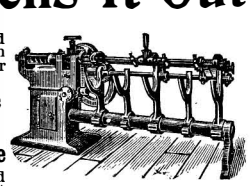

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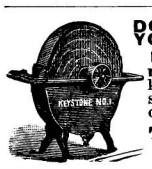

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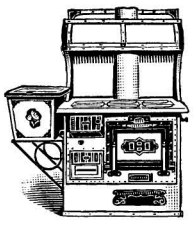

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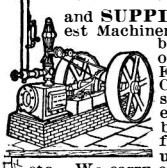

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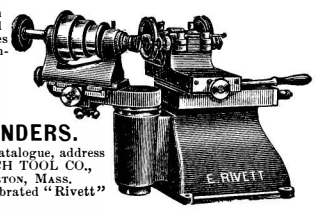

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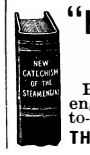

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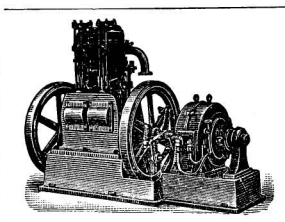

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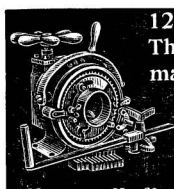

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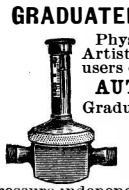

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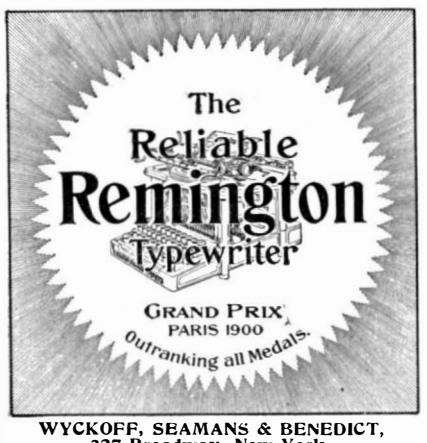

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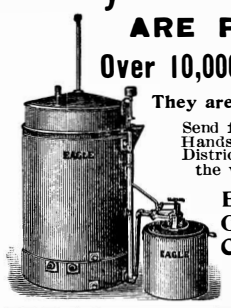

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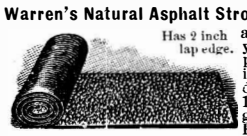

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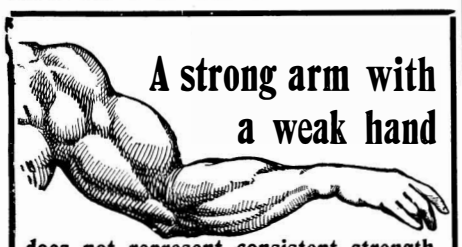

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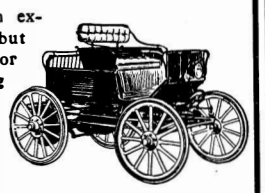

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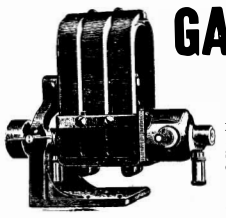

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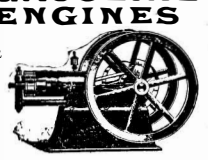

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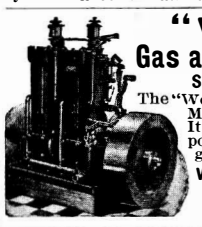

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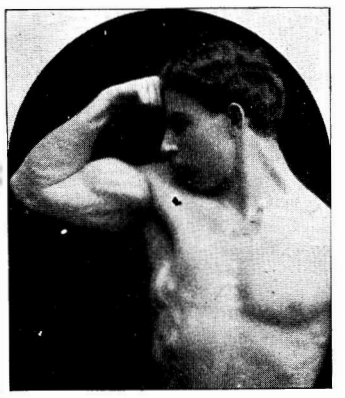

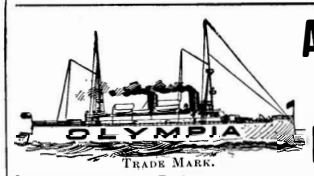

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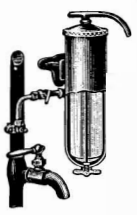

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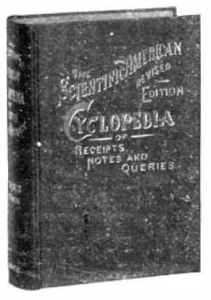

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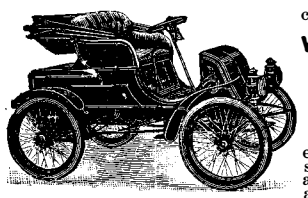

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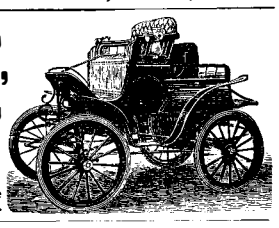

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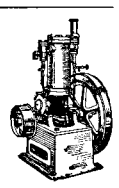

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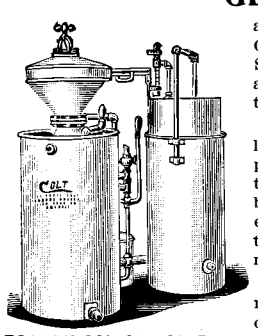

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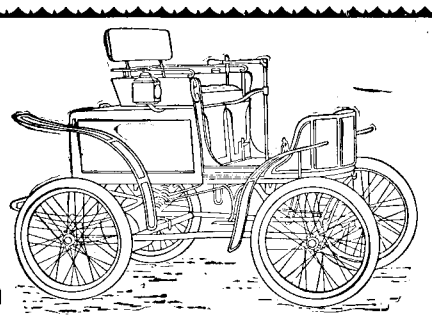

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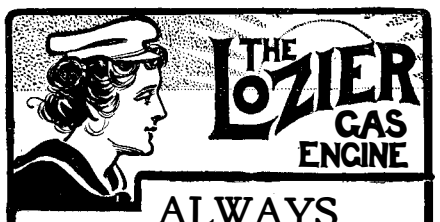

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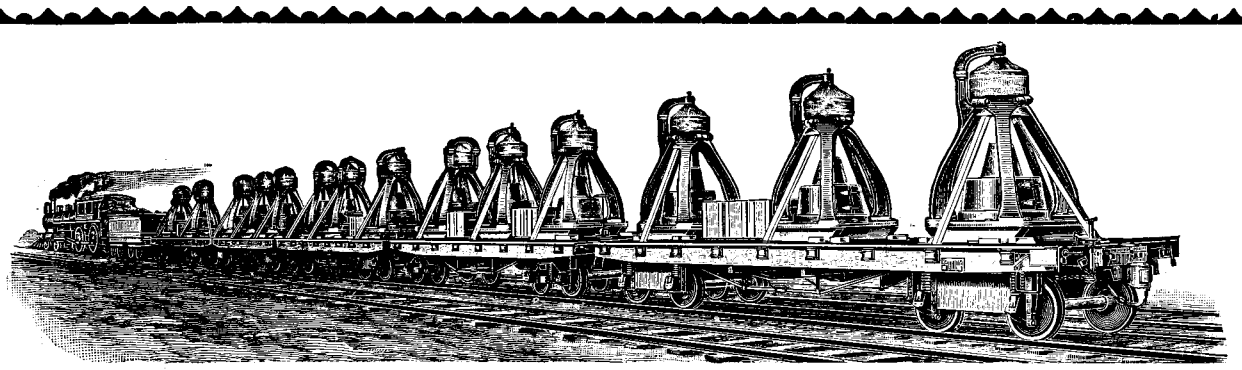

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